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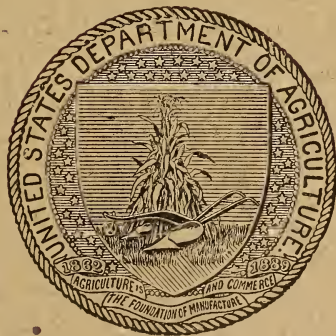
Report No. 75.

INDIAN CORN IN ARGENTINA:

PRODUCTION AND EXPORT.

BY

FRANK W. BICKNELL,
SPECIAL AGENT.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1903.



ARGENTINA: PROVINCES, RIVERS, RAILWAYS AND PRINCIPAL CITIES.

U. S. DEPARTMENT OF AGRICULTURE.

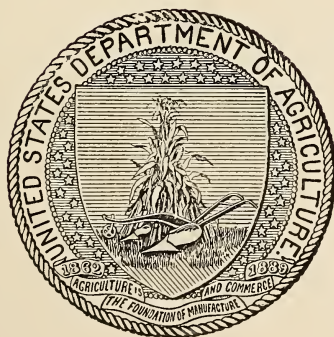
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ARGENTINE TERMS, WEIGHTS, AND MEASURES USED IN THIS BULLETIN.

METRIC SYSTEM.—The metric system of weights and measures is used exclusively in Argentina, except that certain local terms are still somewhat in use, but not officially.

MONEY.—Unless otherwise stated, expressions of value used herein have been converted into United States money. The Argentine gold dollar, or peso, is worth 96.5 cents in United States money. The Argentine paper dollar, in common use, is worth about 44 cents.

KILO.—The short word for kilogram, the metric weight equal to 2.2046 pounds avoirdupois.

HECTOLITER.—A metric measure of capacity equal to 3.531 cubic feet, or 2.8377 bushels, or one-tenth of a cubic meter. It is the standard used to express the specific weights, and thereby the quality, of grain.

TON.—The metric ton is equal to 2,204.6 pounds avoirdupois, or 39.36 bushels of shelled corn.

QUINTAL.—100 kilos, or 220.46 pounds.

METER.—39.37 inches.

KILOMETER.—0.621 mile.

HECTARE.—2.471 acres.

SQUARE.—4.17 acres.

LEAGUE.—6,672 acres.

CHACRA.—A farm devoted exclusively to agriculture.

CHACARERO.—A man who works a farm to raise crops.

ESTANCIA.—A stock ranch.

ESTANCIERO.—A man who owns an estancia, and generally the one who operates it.

PATRON.—The proprietor, the owner of the land rented to "colonists;" the employer of labor, or the head of the establishment on any kind of a farm.

COLONIST.—A renter of land for agricultural purposes, usually a foreigner, hence the term.

CAMP.—The term generally applied to the country, derived from the Spanish word "campo," meaning country. It has another meaning, applied to the land or pastures. A man will say, for instance: "My camp is in good condition."

TROJA.—Corresponds to our corn crib. It is made by setting strong poles in the ground and weaving canes and corn stalks through them to make a circular crib, to hold corn in the ear. Being loosely made, air can pass through the corn. Sometimes it is covered, but more often not.

CANALETAS.—Chutes, made in sections and hung on wire cables stretched from warehouses on the high banks of the Parana River to the ships lying in the stream below. Ships drawing 26 feet of water could be loaded in Rosario and other ports in this manner at trifling expense, but they can not load to more than 18 feet, as a rule, because of the bars in the river below. Besides the temporary canaletas, on cables, permanent chutes for the same purpose are also built on the banks all along the river. Bags of grain, yerba, or flour, bales of hay, tobacco, dried meat, and other cargo slide into the ships in this manner at small cost. This economical method will all be done away with in Rosario when the new port is built, hence shippers are planning to go elsewhere.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., November 25, 1903.

SIR: I have the honor to submit herewith a report upon the production of Indian corn in Argentina and its exportation from that country. The investigation from which this report comes originated in some inquiries addressed to me in December, 1901, by Mr. Frank H. Hitchcock, then Chief of the Division of Foreign Markets of this Department. It was found profitable and necessary to a full understanding of the subject to enlarge the investigation so as to include the methods of production as well as the manner of exportation. The climate of Argentina also is a subject of interest in this inquiry, and a careful statement of climatic conditions, with comparisons with the United States, is presented. Two weather maps, one showing the annual isothermal lines and the other the distribution of rainfall, will serve to illustrate the statement.

The map of the corn district of Argentina accompanying this report gives the railway lines and rivers by which the surplus corn crop of the country is moved for export.

The information here presented will, I believe, be useful to many farmers and business men, and I suggest that it be printed as one of the reports of this Department.

Acknowledgment should be made for generous and valuable cooperation of officials, grain men, and farmers in Argentina in the prosecution of this inquiry. Among the many who were of assistance, special acknowledgment and thanks are due to Señor Don Ronaldo Tidblom, director of agriculture and animal industry; Mr. Russell Smith, inspector of hay, etc., for the British Government, now at the head of the commercial grain and hay inspection service for export from Rosario, Buenos Ayres, Bahia Blanca, and other places; Mr. J. Collett-Mason, estanciero of San Jose de la Esquina, Province of Santa Fe; Señor Eduardo E. Brett, Pehuajo; Mr. W. S. Martin, Rosario; Mr. W. G. Davis, director of the national weather bureau, and Mr. H. B. Coffin, Carcaraña.

Respectfully,

FRANK W. BICKNELL,
Special Agent and Agricultural Explorer.

Hon. JAMES WILSON,

Secretary.

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INDIAN CORN IN ARGENTINA: PRODUCTION AND EXPORT.

INTRODUCTION.

[For Argentine terms, weights, measures, etc., see back of title page.]

The methods, or lack of methods, in growing and harvesting Indian corn in Argentina have a great influence on the success of the exporting business. All these differ widely from our own methods, even more than Argentine corn differs from ours. But progress is to be expected in Argentine corn growing, which is now a separate occupation, not usually carried on by one man in connection with other crops. More and better home use is likely soon to be made of the corn they produce there, and instead of sending the greater part of the increasing crop out of the country, Argentina will in the near future use much of its surplus corn to fatten cattle and hogs for domestic consumption and for export.

THE CORN AREA OF ARGENTINA.

In 1902 the area reported planted in corn in the entire Argentine Republic was 4,433,686 acres, but of this 3,963,897 acres were in the four provinces of Buenos Aires, Santa Fe, Cordoba, and Entre Rios, chiefly in the first two named. (See Pl. I.) The area within which corn is now grown successfully and as a serious business is roughly bounded by a line drawn around points distant from the city of Buenos Aires about as follows: To the south 225 miles and to the west 250 miles, all in the Province of Buenos Aires; to the northwest 325 to 350 miles, into the Provinces of Santa Fe, and Cordoba, and to the north 350 miles, into the Province of Entre Rios. Still, a great majority of the best corn is grown within a much smaller area than this—within 75 to 150 miles of the Parana River and within the same distance of either Buenos Aires or Rosario, the chief corn markets.

Outside the corn district just outlined, for 100 miles or more to the south, west, and north, corn is raised and will be raised in increasing quantities every year. Many parts of the great Territories of the Pampa and Neuquen, to the southwest, and of the Province of San Luis, to the west, are showing unexpected agricultural value. Land in San Luis and northern Pampa has had a tremendous boom during the past year, being wanted chiefly for alfalfa pastures on which to fatten cattle.

The cultivation of corn is a settled business in only a few localities where the greatest yields are secured. Otherwise it is unsteady and uncertain, depending upon the whims of large landowners who may decide to "colonize their camp with maize"—that is, plow up the pastures and put the land into corn, or turn out the wheat raisers and bring in corn raisers.

Wheat growing is going south, leaving the Province of Santa Fe, where it was first introduced, and is being succeeded by alfalfa, corn, and stock raising. This is extending more and more to the north, where colonists have been slow to believe they could grow corn successfully. One obstacle in the way of the country's development is that the farmers or "colonists" are not progressive, being mostly very illiterate persons, who never did any farming before they came to Argentina. They do not read and are very slow to make any experiments or adopt anything new. So it is not always easy to get colonists who have had any experience in corn raising to put in the first crop. Very low rents and favorable conditions are offered at first to get colonists to show what can be done with the land. In other words, corn raising in Argentina is still in the experimental stage, with its possible extent and importance very imperfectly realized.

Most of the corn grown in Argentina is raised north of latitude 36 south and largely in latitudes 35 to 33 south, while the corn belt of the United States is in latitudes 38 to 42 north—that is, the best cultivated corn region of Argentina ends now at a point more than 100 miles nearer the equator than that of the United States begins. There are, to be sure, marked climatic differences in the corn regions of the two countries.^a Most of the temperate zone in Argentina south of latitude 36 south is considered too dry for corn, but this claim is not well established. Superior wheat is grown there, and already it has been found that in some parts at least corn makes a good showing.

With the present prospect that Argentines will soon begin to feed corn to cattle, that they will have hogs to fatten in the same way, and that the methods of corn production will improve, it is reasonable to expect that the production of corn will continue to increase very rapidly in Argentina. The profits of corn raising are sufficient, as the conditions and markets now are, to satisfy the man who works and plans as he should. If the additional inducements of profit from feeding and the good results of better culture are made clear to him, he may be confidently expected to take advantage of the rich opportunities presented by the fertile soil of Argentina. The exportation will, after a few years, not increase in proportion to the increased production. Feeding may be expected to consume an increasing quantity.

^a See p. 10, under heading "Climate of Argentina."

PROSPECTIVE INCREASE OF SMALL FARMS.

Hardly any one thing has interfered more with the development of the Argentine Republic than the fact that most of the good land has been parceled out to a few favorites, at various times, in immense tracts. Until recently it has been difficult for a poor man to get a small tract of land for his actual use and occupation. He could rent, but he could not own. This is gradually changing, though a vast portion of the country is still owned in large blocks by men who are doing nothing to develop it and will not sell at reasonable prices to those who will. The land pays them handsome incomes for grazing and they prefer to hold it for higher prices. But as the country grows older families and estates divide more than formerly. Many colonies have been established and some of the big land companies and farming companies are selling off their land in small parcels. This is being done with the great Curamalan property of 300 leagues, or over 2,000,000 acres, owned by an English company which secured the land thirty or forty years ago from the Government at a very low price under an agreement to stock and operate it.

Mixed farming, as practiced in the United States, is almost unknown. But the country is developing in that direction as land increases in value. It is generally stated and believed that small owners are gradually becoming more numerous, as sales of lands and other evidences, especially systematic colonizing, indicate it. It is not supported by published statistics, however.^a The need and benefit of having farmers who own their land, propose staying in one place permanently, and have an interest in the country is being better understood every year.

^a Statistics published each year by the Argentine Department of Agriculture give the number of cereal farmers classified as to renters and owners. The information upon which these statistics are based comes from the thrashing-machine operators, and is no doubt incomplete and only approximately accurate. It probably has not included anything like all the corn raisers, but it is suggestive of the relative numbers of renters and owners. Condensed and compared with the farm statistics of the United States Census of 1900, these statistics show for four years as follows:

	1898-99.	1899-1900.	1900-1901.	1901-02.	U. S. Census, 1900.
Owners	13, 415	15, 013	13, 815	13, 060	3, 713, 371
Cash renters.....	15, 690	14, 290	14, 715	18, 819	752, 920
Share renters.....	6, 284	5, 100	5, 537	5, 465	1, 273, 366
Total farms reported	35, 389	34, 403	34, 067.	37, 344	5, 739, 657
Percentage of owners	37. 91	43. 64	40. 55	34. 97	64. 69

The statistics for 1901-02 are not quite complete, having been published before the last of the reports had been received, so the number for that year should be slightly increased.

IMMIGRATION.

The Government is very willing to encourage and assist immigration and colonization, in many practical ways. Owing to causes which they are now trying to study out, immigration has fallen off during the past year or two, and often the monthly balance is against the country—more going out than coming in. Many reasons are assigned for this condition of affairs. Complaint is made that the administration of justice is not what it should be, especially in the country, and that a poor foreigner has not much chance; that he is likely also to be burdened with oppressive taxes. Many Italians come to the country to work a few months, in the harvest, and then go home or to North America. The great prosperity and industrial activity in the United States has also had much to do with diverting European immigration from Argentina to this country. Immigrants are learning that Argentina is a poor place for a man without some capital, unless he is willing to live on very little at first and undergo many hardships. The country is, nevertheless, giving opportunity to Russians, Armenians, Boers, and drought-stricken Australians, all of whom are bettering their condition by engaging in agriculture.

CLIMATE OF ARGENTINA.

“What is the climate of the country?” is a question often asked about Argentina. Almost any desired climate, from tropical to frigid, may be had in a country that extends through more than 34 degrees of latitude, or more than 2,300 miles, from latitude 22 to 56 south, and is in places 800 miles wide. (See Pls. I and II.) Conditions vary widely in the same latitude. Rainfall diminishes from the east to the west until the very base of the Andes is reached. (See Pl. III.) Temperature is highest in the central part of the country, falling rapidly in the Andean region to a point many degrees below the temperature of localities due east, in the Litoral, which is the name given to the region including the Territories of Formosa, the Chaco, and Misiones, and the Provinces of Corrientes, Entre Rios, Santa Fe, and Buenos Aires, the best part of the country.

The second climatic division of Argentina is known as the Mediterranean region, embracing the central part of the Republic, from the Bolivian frontier on the north to the southern extremity of the continent, and the Atlantic coast to the south of the Province of Buenos Aires.

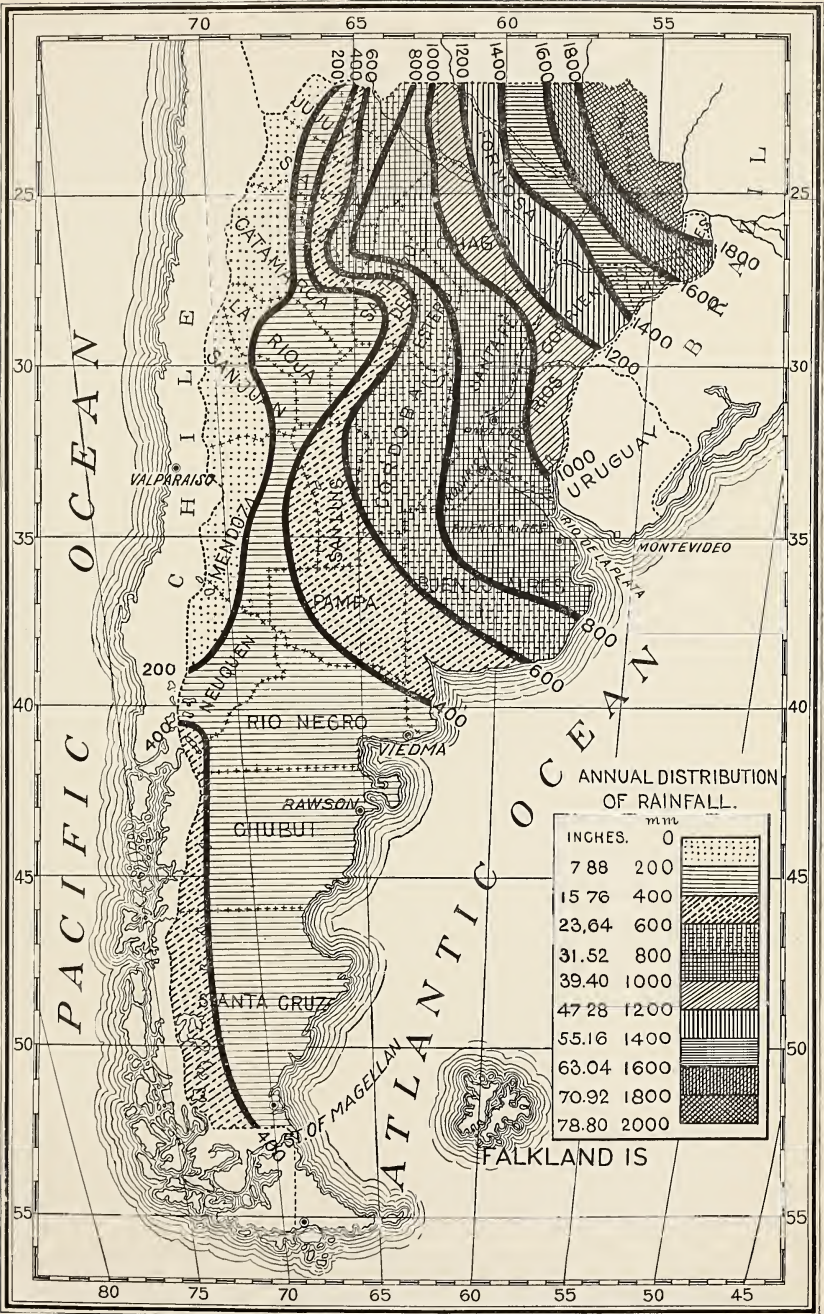
The third division is called the Andean, and comprises the region west of the Mediterranean and includes the eastern slopes of the Andes.

The highest recorded temperature,^a 120°, was during the hot wave

^a The centigrade thermometer is used in Argentina, but all expressions of temperature in this bulletin have been converted into Fahrenheit.



ISOTHERMAL LINES, SHOWING ANNUAL AVERAGES OF TEMPERATURE IN ARGENTINA.



RAINFALL IN ARGENTINA, ANNUAL DISTRIBUTION, VARIOUS REGIONS.

in February 1900, in the Province of Catamarca at the extreme north, and the lowest recorded temperature was 3° , in the southern extremity of the continent, a range of 117° of temperature in 33 degrees of latitude. The Argentina weather bureau states, however, that lower temperatures are probably experienced in the interior of the Territory of Santa Cruz. In the northern part of the Litoral the ordinary range of temperature is from 41° to 106° and in the southern section of the Litoral the usual limits are from 32° to 102° . This is the Territory in which most of the corn is raised, and the summer temperature averages from 72° to 77° and is rarely above 96° .^a

A very good system of weather reports has been organized by the Argentine Government under the direction of Mr. Walter G. Davis, formerly a resident of Vermont, who has been in this service in Argentina for the past twenty-six years. The national telegraph service, which is part of the postal system, carries the reports, and the operators, in many cases, are observers. The best instruments have been supplied to observers and the national telegraph lines have been extended well over the country, so that now observations are reported and the conditions are being studied in the remotest sections. In the hands of the capable director the service is well organized and efficient. Weather maps similar to those issued in this country, are published daily by the Weather Bureau in Buenos Aires.^b The temperature of the various parts of the country is shown by the isothermal lines as follows:

SUMMER.

The summer isotherm^c of 77° starts on the Uruguay River in about latitude 31 south, runs through the upper edge of the Province of Entre Rios, through central Santa Fe, and downward to the city of Cordoba, where it dips south to the lower part of San Luis and Mendoza, and from there turns upward along the lower slopes of the Andes to Bolivia.

The summer isotherm of 75° begins at about latitude 33 south, runs west across the lower part of the Province of Entre Rios; thence southwesterly through the city of Rosario, across the southern edge of Cordoba and San Luis, the northwestern corner of the Pampa, and then

^aThe average annual temperature of the corn belt of the United States is about 50° . The season averages in Iowa are: Winter, 20.9° ; spring, 47.3° ; summer, 72.3° ; autumn, 50.1° . The corn belt lies between the isothermal lines of 45° and 55° , annual.

^bThese maps have only been published a little over a year, and the service is not entirely perfected in the more distant parts of the country.

^cThe temperatures used to form the isothermal lines have been reduced to the level of the sea at the rate of 1° Centigrade to each 200 meters of altitude, or 1.8° Fahrenheit for each 656 feet. The corn region is scarcely affected by this operation, since it is nearly all less than 200 feet above sea level.

up through Mendoza, San Juan, La Rioja, Catamarca, and Salta to Bolivia.

The isotherm of 73° begins in about latitude 33.5 south and crosses the northern part of the Province of Buenos Aires, takes a south-westerly course through the central part of the Territory of the Pampa, and makes a curve from the central part of the Territory of Neuquen upward to about latitude 35 south.

The line of 72° starts at Buenos Aires, latitude 35 south, and follows a general southerly direction across the Province of Buenos Aires, the southwestern corner of the Pampa, the northwestern corner of Rio Negro and central Neuquen to the Andes.

The line of 70° starts at the seacoast in latitude 37 south, runs southwest along the coast to latitude 40 south, whence it crosses the Territory of Rio Negro, dipping a little to the south, and up a trifle north of latitude 40 south in Neuquen.

Autumn temperatures average in the temperate zone about 11 degrees cooler than summer.

WINTER.

The winter isotherm of 70° runs from the southeast corner of the Territory of Misiones, in latitude 27 south, to lower Catamarca, in almost a straight line, thence north to Bolivia.

The line of 57° , beginning in latitude 30.5 south, crosses lower Corrientes, central Santa Fe, northern Cordoba, south to the city of San Juan, and north to Bolivia.

The line of 55° , beginning in latitude 31 south, runs across Entre Rios to the city of Santa Fe, a little north to the city of Cordoba, southwest to the city of San Luis, through Mendoza northwesterly, and north to Bolivia.

The isotherms of 54° and 52° , beginning in latitudes 32 and 33.5 south, respectively, are nearly parallel with line 55° .

The isotherm of 50° begins at about latitude 34.5 south, a few miles north of the city of Buenos Aires, runs northwest to the middle of the lower point of Santa Fe, thence southwesterly along the borders of Buenos Aires, the Pampa, Cordoba, and San Luis, and upward through Mendoza to about the same latitude as that of the starting point.

The isotherm of 48° starts on the coast at about latitude 35.5 south and dips downward through the Province of Buenos Aires to a point about 50 miles north of Bahia Blanca, where it crosses the Pampa and Neuquen on a slight upward incline, ending in a sharp upward turn to latitude 37 south.

Below this the lines are more nearly east and west, both summer and winter. At latitude 39.4 south the winter temperature is 46.4° . At latitude 44 south it is 43° .

The spring temperatures average about 11° to 12° warmer than the winter temperatures.

ANNUAL AVERAGE TEMPERATURE.

The highest annual average is 75° . This is in the northern part of Formosa and Jujuy, near the Tropic of Capricorn. At every 70 to 150 miles south the temperature is about 2 degrees cooler. The line of 66° , annual average, runs straight across the northern part of Entre Rios, central Santa Fe, and downward to the cities of Cordoba and San Luis, curves downward 50 miles south of the city of Mendoza and up to a point on the boundary due west of the last-named city. The isotherm of 63° goes across lower Entre Rios, just south of the city of Rosario and due southwest along the borders of Buenos Aires, Cordoba, San Luis, and the Pampa to Chos-Malal. At La Plata the isotherm of 61° begins and runs a little north to central northern Buenos Aires, where it bears off to the southwest, through the Pampa a little south of the center, into Neuquen. Bahia Blanca is in the line of 59° and from this point the lines are more nearly uniform, the temperature being about 2 degrees warmer on the Atlantic coast than at the base of the Andes. It averages about 2 degrees lower each 125 to 150 miles south until at the end of the continent, in about latitude 56° south, it is 41° .

The isothermal lines shown in the map given herewith (Pl. II) indicate average temperatures for the year from actual observations, not reduced to sea level. No temperatures taken in deep valleys or on high mountains have been considered, but only those that fairly represent the altitude of the region.

Observations of temperature have been made in the city of Buenos Aires since 1856. They are printed in three periods and the averages are, by seasons, as follows:

Average temperatures at Buenos Aires.

Season.	1856-75.	1876-96.	1897-1900.
	$^{\circ}F.$	$^{\circ}F.$	$^{\circ}F.$
Summer (December, January, and February)	74.3	72.5	75.3
Autumn (March, April, and May)	63.1	61.5	64
Winter (June, July, and August)	51.9	51	51.4
Spring (September, October, and November)	62.6	61.3	61.5
Year.....	62.9	61.5	63.1

These averages are not far from the averages of the principal corn regions, being but a trifle cooler than the northern part thereof.

EFFECT OF HUMIDITY ON TEMPERATURE.

Though the temperature of the warmer part of the present best corn area, southern Entre Rios, Santa Fe and Cordoba and northern Buenos Aires, is not often above 96° , it seems 15 or 20 degrees hotter most of the time because of the high percentage of humidity. In the city

of Cordoba, the altitude of which is 1,000 to 1,200 feet higher than the farming country below, the average annual percentage of relative humidity is 64. In Buenos Aires and Rosario it is 78.^a In the northern part of the Litoral, the Territories of Misiones, Formosa and the Chaco, and the Province of Corrientes, the relative humidity is 10 per cent greater. The report of the Argentine Weather Bureau contains the following concerning the effects of humidity:

It is not an uncommon occurrence in summer that the temperature of the air, during the hottest hours of the day, is considerably higher in the region of Chubut and Rio Negro than in Corrientes or the Chaco, 16 to 18 degrees nearer the equator. In the first-named region, however, one scarcely feels the heat; whereas, in the latter, the temperature is very oppressive. This is explained by the fact that the temperatures of the wet bulb thermometer are much lower in the southern territories, when these phenomena are observed, than those recorded in the northern region. In the city of Buenos Aires a temperature of 95° is very rare, while in Cordoba it is not exceptional in autumn and spring, and is frequently observed during the summer. In the first-named place this degree of heat causes a suspension of all labor that can be postponed, while in Cordoba it does not give the impression of being excessive, and work is carried on without inconvenience.

WIND.

The effect of winds on temperature in Argentina is stated by Director Davis, of the Argentine Weather Bureau, as follows:

The north winds are hot, and the increase in the heat is, as a rule, proportional to the duration of the wind from this direction, while the south winds are cool, refreshing the air and relieving the suffocation produced during the successive days of north wind. In the Andine region the dry and hot winds are called *zondas*, which generally blow from north to northwest, and at times with such intensity that respiration is difficult. These winds rise about midday and last till sunset, but at times they last two or three days without interruption, being strongest in spring in the months of September and October. The changes of temperature after a severe *zonda* and the south wind which follows it are frequently as high as 45°. In the Litoral and Mediterranean the heat produced by the north wind generally terminates with a thunder storm or *pampero*. The *pamperos* in the Litoral are more frequent in winter and spring. The change of temperature caused by the two winds is frequently from 27° to 36°.

RAINFALL.

The average annual rainfall in the corn district of Argentina is 31.52 to 39.40 inches, and it is quite evenly divided between the seasons.^b

^a The average annual percentage of relative humidity in Iowa for the past 25 years has been 70 per cent, and for the crop-growing period, May 1 to September 1, it has been 69 per cent.

^b The surplus corn States of the United States have an average of about 35 inches of rainfall, the range being from 27 inches in the northwestern part of the belt to 40 inches in the southeastern part. The average for Iowa is 31 inches for the whole State, of which amount 70 per cent falls in the six crop months, April 1 to October 1, and over 50 per cent in the four months, May 1 to September 1. By seasons, the State averages are: Winter, 3.32 inches; spring, 9.19 inches; summer, 12.02 inches, and autumn, 6.53 inches.

From October to March is called the wet season, and from April to September the dry season, in that part of Argentina north of latitude 38 south.

In Buenos Aires 56 per cent of the annual rainfall is in the wet season; in Corrientes 65 per cent of the rain falls in the wet season; in Cordoba 86 per cent, and in Salta 96 per cent. In the region south of latitude 38 south the distribution of rainfall is very even through the year. Snow falls every year in the Territories of Santa Cruz, Chubut, Rio Negro, and Neuquen, but it rarely reaches the Province of Buenos Aires.

The average annual rainfall in a number of representative localities is given herewith:

Average annual rainfall in Argentine cities.

Station.	Latitude.	Longitude.	Years of observation.	Rainfall.
	° ' "	° ' "		<i>Inches.</i>
Villa Formosa.....	26 12	58 6	1879 to 1892.....	57.14
Corrientes.....	27 28	58 50	1876 to 1900.....	49.28
San Lorenzo.....	28 10	58 45	1892 to 1900.....	35.16
Goya.....	29 9	59 16	1876 to 1900.....	38.31
Monte Caseros.....	30 14	57 38	1893 to 1900.....	40.65
Concordia.....	31 23	58 4	1876 to 1878 and 1887 to 1898.....	42.05
Parana.....	31 44	60 31	1875 to 1882 and 1896 to 1898.....	35.45
Uruguay.....	30 30	58 13	1895 to 1899.....	45.49
Carcaraña.....	32 49	61 8	1889 to 1900.....	35.14
Rosario.....	32 57	60 38	1875 to 1880 and 1886 to 1900.....	37.46
Buenos Aires.....	34 37	58 22	1861 to 1900.....	36.76
Estancia San Juan.....	34 49	58 3	1867 to 1900.....	42.57
Dolores.....	36 18	57 40	1889 to 1900.....	32.32
Malpu.....	36 51	57 53	1888 to 1900.....	26.77
Azul.....	36 45	59 50	1888 to 1900.....	32.29
Tandil.....	37 17	59 8	1888 to 1900.....	32.47
General La Madrid.....	37 13	61 16	1888 to 1900.....	25.73
Bahia Blanca.....	38 45	62 11	1860 to 1883 and 1896 to 1900.....	20.58
La Carlota.....	37 10	63 50	1891 to 1900.....	21.53
Rawson.....	43 17	65 5	1880 to 1888 and 1896 to 1900.....	9.46
Salta.....	24 46	65 24	1873 to 1897.....	22.08
Tucuman.....	26 51	65 12	1873 to 1900.....	38.02
Santiago del Estero.....	27 48	64 16	1873 to 1890.....	19.57
Cordoba.....	31 25	64 12	1873 to 1900.....	27.48
Rio Cuarto.....	33 7	64 19	1881 to 1882 and 1900.....	26.46
San Luis.....	33 19	66 20	1874 to 1877.....	21.57
Catamarca.....	28 28	65 55	1881 to 1900.....	12.67
La Rioja.....	29 19	67 1	1875 to 1892.....	10.78
San Juan.....	31 32	68 31	1875 to 1900.....	2.93
Mendoza.....	32 53	68 49	1866 to 1880 and 1885 to 1900.....	7.08
Chos-Malal.....	37 27	69 49	1892 to 1896.....	7.52
Ushuaia.....	54 52	68 7	1876 to 1885.....	23.15
Isla de los Estados.....	54 23	63 47	1886 to 1893 and 1899 to 1900.....	54.06

The distribution of rainfall throughout the country is graphically shown by the chart (Pl. I), which was made by the Argentine Weather Bureau from observations at more than 150 stations well distributed over the country, covering periods from eight to twelve or more years at most of the stations. The observations in the interior of Formosa and the Chaco, and in the region at the foot of the Andes south of latitude 38 south, were not sufficient for a permanent record, but otherwise further observations may not be expected to show changes, says Director W. G. Davis in his report.

The records also show that the rainfall was well distributed through the months and the days of the months. Rain falls, on the average,

42.2 days per year in Corrientes, 39.2 days in Goya, 55.7 days in Concordia, 50.3 days in Parana, 59.2 in Buenos Aires, 82.2 days in Tandil, 53.5 in Bahia Blanca, 70.3 in Cordoba, 68 in Rio Cuarto, and 58.8 in San Luis.

THE PRODUCTION OF CORN.

EXISTING CONDITIONS AND METHODS, AND PROBABLE IMPROVEMENT.

The production of maize, or Indian corn, in the Argentine Republic, while it has been going on for many years, is only now developing into a great industry. It is just growing out of the primitive methods that have been holding it back and which still prevent farmers from realizing much more than half what they might. The results they achieve are due to the marvelous fertility of the soil and the perfect climatic conditions, which, in spite of bad methods, neglect, and general ignorance, give bountiful harvests to men who would utterly fail in the corn belt of the United States if they farmed as they do in Argentina; and these men can not long continue in this manner where they are. Their only natural disadvantage is that they are likely to get too much rain during the gathering season and they may have too little during the growing season; but where they have a range of about five months in which to plant corn and still be reasonably sure of a crop, much of the fear of insufficient rains during the plowing, planting, and growing seasons is taken away.

The methods of cultivation are improving every year, as the corn area extends and the leaven of modern ideas slowly penetrates to the slow-thinking colonist. He would progress much faster in the United States, because he would have the example of better farmers all around him, while in Argentina he sees nothing better than his own miserable efforts, and he is no theorist, to adopt new methods simply because some one has told him to do so. The chances are that he has never seen anything grow before he came to be a "chacarero" on some large place in the new southern country. Never having had any land to work before, never having had room enough to live or a chance to do anything on his own account, he becomes greedy when he sees so much land on which he is free to go, and wants to take far more than he can work well. Every colonist wants at least 100 hectares, equal to 247 acres, and sometimes he succeeds in getting more. This is, however, the usual limit for a family, unless there are several large boys. The rule on some large corn farms is that 25 squares, or about 104 acres, shall be allotted to every able-bodied working hand. Farming as they do, a man can work that amount of land in corn until the gathering is upon him, when he must have help or suffer heavy losses.





FIG. 1.—HUT OF ITALIAN "COLONISTS" IN ARGENTINA.



FIG. 2.—FIELD OF CORN IN ARGENTINA JUST BEGINNING TO TASSEL, ITALIAN COLONIST IN CENTER.

THE FARMER AND HIS HOME.

Most of these "colonists," or renters, are from the north of Italy, and are very industrious and thrifty. They work and live under conditions that would not be endured by the poorest farm hand in our country. Yet they have here a chance that they could not have at home, and most of them become well off in a few years. But a great many of them do not like the country, and are leaving it and returning to Italy or coming to the United States. The reason most commonly given is that they are oppressed by the petty local officers and made to pay excessive taxes and unjust fines. Some of them, however, become citizens and occupy positions of influence among their fellows. Others desire only to accumulate money to live comfortably in Europe. A better class of corn farmers are the Austrians, who are not numerous. They build frame houses and live far better than the Italians, and yet seem to make as much money. The Italian renter builds a mud house with a zinc roof, all the materials being furnished by the "patron," the owner of the land. Several hard-wood posts are set in the ground and small boards nailed across the top. The sheets of zinc are then spread over the frame for a roof, with a slight pitch. Wire is tied from post to post and cornstalks woven in, the wire holding them up. Mud is plastered on both sides of the stalks and soon dries. A hole is left for a door, and perhaps, but not always, a smaller hole for a window, and the house is done. I made a photograph of one of these dwellings, which was about 12 feet long and 8 feet wide (Pl. IV, fig. 1). Four men and a boy lived in it, and were doing a good business, cultivating something over 400 acres of corn. The head of this gang is the one shown in the picture (Pl. IV, fig. 2) standing in the corn, which at that time, December 22, was about eight weeks old.

LAND RENTING, INCLUDING TERMS, PRICES, ETC.

These men came to the land with nothing but their strong bodies as their capital. The big Italian standing in the corn was the boss and the responsible man, if anyone was responsible. The owner of the land had this contract with them: He gave them the land, material to build the house, plows, harrows, cultivators, planting machines, necessary mules and bullocks to work, and two horses to draw water and ride in caring for the other animals. He became responsible for their credit at the country store for an amount equal to about \$12 of our money, per month and they fed themselves, paying the account at the store when they received their share of the proceeds of the crop. One-third of the cost of the seed, harvesting, and shelling was charged to the tenants. They agreed to work the land to the satisfaction of the owner, and for all this they received one-third the proceeds of the sale of the crop, the owner selling when he saw fit. It is on some such

terms as these that the poor man gets his start, and in a year or two he advances to the next stage, where he furnishes everything and delivers to the owner at his warehouse a share of the crop ranging from 16 to 22 per cent—16 per cent the first year, 18 per cent the second, third, and fourth years. Other contracts call for 20 per cent the first year, 21 the second year, and 22 the third and fourth years. This was in a comparatively new district, the advantages of which were not so well known. Higher rents are obtained elsewhere, nearer the Parana River, where the land is known to be very rich and the market is very near. The third step of the corn raiser is the payment of cash rent.

The cash-rent system is the one generally in vogue, though nearly every large "chacra," or farm devoted to agriculture, has all three plans in operation. The prices paid vary greatly, according to location and supposed fertility of the land and its adaptability to corn. The price on the place I am speaking of, which is located 70 miles west of Rosario, was from \$5 to \$9 per square, which is a fraction over 4 acres. The latter is now the ruling price and it will probably soon be advanced. The lower price was offered when the land was converted from wheat—which was a failure—to corn, to induce the better class of corn farmers from nearer the river to come out there and take the land. Now that its adaptability to corn is established, the owner will doubtless have no trouble to rent it to good men, as renters go in Argentina, for higher prices than he is now receiving. In the best corn lands, near the Parana River, rents have been paid as high as \$4.25 an acre, but this is exceptional and above the average, even for the best lands. Half of this rent must be paid in advance and the colonist agrees to use all the land, except 4 per cent for his house, garden, corrals, etc., for corn or linseed; and only 10 per cent for linseed. He agrees to keep out all noxious weeds and he must plow and cross plow before planting, dropping the seed corn behind the plow the last time with a machine attached to the plow. Then he must follow with the harrow, and harrow again after the corn is up, and cultivate once with a single-shovel, one-horse cultivator. Hardly a farmer cultivates his corn more than once, and only one way, but many of them are required by their contracts to go through after cultivating and pull the worst of the weeds.

In other parts of the country, farther south, in the Province of Buenos Aires, rents for corn lands range from \$1.50 to \$2.50 per acre, depending upon how near the market and how good the land. While most of the corn is raised by renters, the number of small proprietors is slowly increasing.^a The valuation generally put upon agricultural land is to call the rent 8 per cent of the value. But land can be bought cheaper than this if one knows where and how to go, especially in large tracts. The best farming land in the country has been selling at

^aSee footnote, p. 9.



FIG. 1.—CORN OF DIFFERENT AGES IN SAME FIELD IN THE PROVINCE OF SANTA FE.



FIG. 2.—PORT OF ROSARIO, ARGENTINA, LOWER LEVEL.

prices ranging from \$6 to \$15 an acre. A tract of 1,943 acres about 75 miles west of Rosario, in an excellent corn district, was sold for \$13.75 per acre, \$3,500 down and the balance in annual payments at 6 per cent interest. Land within 50 miles of Buenos Aires is worth three to four times as much as this.

THE FARMER'S FOOD AND DRINK.

Formerly colonists were allowed as much as 12 per cent of the land allotted to them, rent free, for pasturage, corrals, house grounds, etc. Now they have to pay for it all, even the 4 per cent which they are allowed for such purposes. But it must not be supposed that the colonists want this land for gardens, for they very seldom have them. Rarely do they raise as much as a cabbage, living on bread and meat and a few potatoes, and perhaps a few other vegetables that they buy. They might have fine gardens, but they are intent on making the land produce all it will that is marketable. Comforts and luxuries are not included in their ideas of life in Argentina. They have two meals a day, at about 11 and 7, with little besides the "yerba maté," or Paraguayan tea, early in the morning. This wonderfully nourishing and muscle stimulating drink is sucked through a tube from a gourd that holds about 4 ounces of water. Boiling hot water is repeatedly poured over the tea leaves in this gourd, and one filling suffices for a dozen fillings of water. The same tube is used by everyone present, even when there is company. It is a very wholesome beverage, in use all over Argentina, and the common people are very much attached to it. Some of them put sugar with it, but it is more wholesome without, though it is quite bitter.

LONG SEASON FOR PLANTING.

Planting of corn may begin as early as August 15, but generally not until three or four weeks later, and it may be as late as January 15, though generally it is not considered quite safe to plant later than December 20. (See Pl. V, fig. 1.) On the 18,000-acre place which I have referred to, at San Jose de la Esquina, some planting was done as late as January 12 this year and a fair crop secured. The early planted corn was ripe at the end of January, but harvesting was not commenced until the latter part of February. Three men came to this place at the end of August and plowed, cross-plowed, planted, and cultivated 400 acres themselves and had a good crop, averaging about 40 bushels to the acre. In adjoining fields may be seen corn in full tassel and corn just out of the ground. Of course the early corn generally has the best chance, because it then gets the full benefit of the hottest weather to mature and ripen. The latter part of the summer is likely to be rainy, and in damp seasons the plants grow to such a size and are so close together that the lower ears do not get sufficient

air or sunshine to ripen or dry out. This results in uneven dryness of ears in the same field. Corn of uneven ripeness is likely to cause trouble and, being deficient in starch and having its sugar imperfectly formed, is inferior in food value, besides being likely to heat and mold and spoil other better grain. The unripe condition of corn exported is not always discovered until it has been sent across the ocean and caused some losses on the voyage. Often late planting is due to drought in the spring, which prevents plowing. Disk plows from the United States are now being introduced to a considerable extent, both among corn farmers and wheat farmers, as they have been found of great value in dry seasons when the ordinary mold-board plows could not be used.

GATHERING, CRIBBING, AND SHELLING.

Farmers are usually in a hurry to get their money and so are apt to gather their corn too soon and have it shelled too soon. Shippers are eager to get cargoes off while the weather is dry, and this stimulates premature marketing. It is in the harvest season that the Argentine farmer has his greatest trials. Almost invariably he has more than he can gather without extra help, and that is difficult to get. Often, to save time and realize on his crop sooner, he arranges to shell directly from the field, rushing his grain to market before it has had any chance to dry. When this is not done—and oftener it is not—the corn in the ear is put into a crib, called a “troja,” which is a round receptacle made of poles stuck in the ground with wire and cornstalks woven in among them, making a sort of bin, not always covered. This being more or less open gives the air opportunity to circulate through and dry the corn, especially if the troja is thatched over. They serve the same purpose as our cornercribs do. The corn is gathered into sacks in the field and carted to these deposits. It is never husked into a wagon box in the field, as in the United States. The sacks of ears, husked, weigh about 143 pounds, and the men are paid by the sack for husking. Ordinarily the men are paid about 8 cents per sack and boarded, or 10 cents per sack and board themselves, but this year the demand for help has been so great, owing to the immense crop, that prices for husking have gone to about 11 cents per sack and board, up to as high as 16 cents per sack without board. A man will gather 8 or 10 bags per day. This year’s crop is the largest the country has ever had and prices are very good—about 40 cents per bushel—but the farmers are suffering heavy losses because they have been unable to get men to work in the harvest. Even better prices than those quoted have been offered and the cities are full of idle men, and still the corn is rotting in the fields. These prices for labor may not seem high to a farmer in our country, but farm laborers in the Argentine Republic usually get about \$13 a month and their board, which costs their

employers but a very small sum, not more than \$4 a month at the most, and usually less. It is estimated that the cost of gathering, shelling, and bagging is about 13 cents per bushel.

Shelling is usually done alongside the trojas, which hold from 1,500 to 8,000 bushels of corn in the ear. Sometimes the corn is shelled at once, without any opportunity to dry, or it may remain in the troja several months. It has been found best by experience that the least possible time should elapse between the time of shelling and loading on shipboard, and the Argentine Department of Agriculture has so advised. "It is better to run the risk of some extra cartage during the winter when the roads are bad," says one man of wide experience, "than to let the grain become heated in bags when deposited in a warehouse." Nevertheless, farmers are more apt to shell their corn as soon as they can get a machine. In many instances the man who runs the machine also buys the grain on the spot, paying 19 to 35 cents per bushel shelled and making no charge for shelling or bagging. Prices for shelling range from $1\frac{1}{2}$ to $2\frac{1}{4}$ cents per bushel. All corn, as well as wheat, is shipped to market in bags weighing in the neighborhood of 150 pounds. These are coarse burlap bags and are worth about 10 cents each.

MISTAKE OF CLOSE PLANTING.

Aside from lack of cultivation, the principal mistake of the Argentine corn grower is his unwillingness to give his plants room enough to grow and get air and sunshine to mature and ripen. As previously stated, most of the corn is planted with a machine attached to the plow, and the rows are generally about 20 inches apart—simply drilled in, resembling very much a field of fodder corn in this country. A few of the farmers are learning better, and perhaps 100 American corn planters have been sold in Argentina. But no check rowers were seen, and there is so little cultivating corn two ways that it is still spoken of as a curious thing—this "North American checkerboard plan" of planting corn—and scarcely a farmer in the country follows that plan. The Basques, the most industrious and successful class of Spaniards, go in for better methods. The Catalans, from the Province of Catalonia, Spain, are also engaged in corn growing in the Province of Buenos Aires. In some sections, notably to the southwest of the city of Buenos Aires, where some of the best corn farming is done, it is noticeable that the better the farming, the more experienced and successful the farmers, the wider apart the rows are, and occasionally a field is cultivated both ways. The rows in the better cultivated sections are from 24 to 30 inches apart, and the plants in the rows about 20 to 24 inches apart. Corn is hardly ever planted farther apart than this, and the greater part, in fact nine-tenths, is in rows 20 to 22 inches apart, and the plants no farther apart in the rows and generally much closer together.

GOVERNMENT EFFORTS TO SECURE WIDE PLANTING.

The Argentine Department of Agriculture has tried to teach the farmers the benefits of planting farther apart, but they are hard to convince. Men have been sent around in various sections saying to farmers: "Give us a hectare of land and we will plant it and cultivate it the way we think it should be done; we will bear all the expense and you may have all the crop." These experiments have always resulted in producing twice as much, or more than twice as much, as the farmer raised alongside in the old way, because the corn was given plenty of room and was well cultivated. But the ignorant farmers have not always been convinced. When asked how they were going to plant next year, some of them said they intended to go on as before. When asked why, and if they had not seen the good results of the improved methods, they have replied: "Oh, that was just luck; you couldn't do it again." Until recently corn was simply sown broadcast, by hand, covered in some primitive fashion, and nothing more done with it until it was gathered in the fall. Even now much of this is being done in some parts, though not in the districts where corn grows best.

SURPRISING YIELDS.

It is surprising to a North American to see what yields result from such slovenly agriculture. The yields vary greatly in different sections under different treatment and because of varying soils or climatic conditions. There are no complete and reliable crop statistics, such as we have; but, from careful observation and inquiry and from the study of such statistics as are available, very close estimates may be made of the corn yield in various sections. In some places a yield of 25 bushels to the acre is considered fair; but these are outside the preferred corn area and do not represent the best cultivation, even of the Argentine farmer. On the other extreme we find on the rich alluvial lands between Buenos Aires and Rosario, not more than 70 miles back from the River Plate and the River Parana, and in the splendid new country to the west and southwest of Buenos Aires, where the best cultivation is done, the yields run up to 70, 90, and even as high as 110 bushels to the acre. But these are above the average for the average corn country. In the larger part or, say, three-fourths, of the area that may be considered corn country, fairly tested and farmed by the better class of farmers, the average crop is better than 40 bushels to the acre. In the better sections, say one-third of the entire preferred corn area, a conservative estimate would be 50 to 60 bushels to the acre, with many fields showing better results. But beyond the favored "coast district," as it is called, a section about 70 miles wide and perhaps 300 miles long, swerving inland to the west from Buenos Aires and reaching up beyond Rosario, they are learning that proper methods will produce almost, if not quite, as good results.

Places that have rented for 35 to 80 cents per acre and where 23 to 32 bushels an acre was considered very good with simply planting behind the plow, without any cultivation, have shown yields two and three times as great when properly planted and cultivated.

In the future corn production in Argentina is sure to be brought to correspond more nearly with the methods pursued in the United States.

ARGENTINE CROP AND EXPORT IN RECENT YEARS.

At present considerably more than half the corn grown in the country is exported. The statistics prepared by the Argentine Department of Agriculture, the only statistics available, give the area planted in 1901 at 3,473,722 acres and the total yield of the country at 84,018,265 bushels, or an average of 24.18 bushels per acre. Of this crop the custom-house statistics show an exportation of 46,843,282 bushels. Owing to the system of preparing these statistics, this amount is probably slightly in excess of the amount actually exported, but only slightly. This crop was grown between September, 1901, and March, 1902, and 90 per cent of it was marketed between March and October, 1902.

The corn crop of the United States was short in 1901, so it is not fair to use the crop and exportation of that year for comparison. But in 1900 the area planted to corn in the United States was 83,320,872 acres. The total production was 2,105,102,516 bushels, and the average yield per acre was 25.3 bushels. The exportation that year (1900-1901), including corn meal, was 181,405,473 bushels, or 8.62 per cent of the total production, while the Argentine exportation in the calendar year 1902 was 55.75 per cent of the total production. Of course the shortage of the corn crop in the United States in 1901 stimulated prices and exportation from Argentina in 1902, but this is the general rule, that half, or more than half, of the Argentine corn crop is exported when there is a good crop.

In 1902 the State of Iowa alone had 9,302,688 acres of corn, against 3,473,722 acres in the entire Argentine Republic in 1901-02. While Argentina sent out of the country 55.75 per cent, or 46,843,282 bushels of her total production of 84,018,265 bushels, the State of Iowa kept in the country of its growth all but 32,745,462 bushels, or 11 per cent of the crop, which was 297,686,016 bushels. The comparison would be much stronger if we could know the amount of corn shipped away from the place where it was grown in Argentina, but not sent out of the country. It would be at least 80 per cent of the crop and probably more.

This year (1902-03) the acreage of the crop harvested from February to June in Argentina is reported at 4,433,686 acres and the yield, not yet fully reported, is known to be larger per acre than the previous year. Owing to many difficulties this crop has not been

coming to market as fast as it should, yet the shipments up to November 5, 1903, were more than 50 per cent greater than they were up to that time a year before. It is generally estimated by competent persons in Argentina that the exportation this year will be about 75 per cent more than last year.

But at present the production of corn in Argentina is an uncertain business, owing to the difficulties of the harvest and the marketing and to the fact that the value of the crop depends so largely upon conditions in other countries. For instance, the price in 1901 held up high until early in June, when, the reports from the United States being favorable, the price in Europe went down, until it was about the same as it is now, averaging around 40 to 42 cents per bushel for the best in the River Plate markets. Of course it is a good business at that price, and might be much better if the methods of cultivation and harvesting were improved.

PROSPECTIVE INCREASE OF FEEDING CORN TO STOCK.

The most far-seeing Argentines realize that they must adopt the North American policy of sending corn to market on four legs, in the condensed form of beef and pork. One of the best known and most experienced of the farmers and stockmen of the western part of the Province of Buenos Aires, where some of the best corn is raised and a comparatively good class of farming is done, said:

We have no reliable market for our corn. Europe at any time may take much or none. Brazil and the Cape are progressing too slowly to be of any consequence. We are all therefore extremely careful not to invest all we have in corn. Its future here depends entirely on our ability to provide home use for it. This we are starting to do. A few are planting corn to fatten export cattle and hogs. Most farmers cultivate roughly, one way only, with horse shovels. They have generally no idea of proper distance to plant or how to cultivate. For the most part the farmers are illiterate men who never did any farm work before coming to this country. Under such circumstances it is surprising to see how well they do get on. They are chiefly Spaniards (from the province of Catalonia) and of late years more Italians. They obtain from 40 to 70 bushels to the acre and in the vicinity of Chacabuco (127 miles west of the city of Buenos Aires) 90 bushels to the acre was quite common last year. Rent varies from \$1.60 an acre outside, say 70 miles from the river, to \$2.25 an acre inside. Most of the land is rented, but small proprietors are fast increasing, hence the manner of cultivating is rapidly increasing. This is shown by the increasing amount of improved machinery and implements sold. I think the fact that a large amount of the corn exported is used for distilling accounts in part for carelessness in shipping.

A general opinion was found to prevail among the better class of "estancieros" that they must grow and feed corn. One man offered extremely liberal terms to secure some North American corn raisers to come down and use some of his land, well suited for corn, to show how the crop should be grown. These men differ from the common farmers, or "colonists;" they are quick to take up new methods when they become convinced that they can make money by doing so. Once

they get started into anything they go into it heavily, as they have into alfalfa. As soon as they fully realize, as some of them now do, that corn is the other thing they need to supplement alfalfa in the production of beef, we shall see them going in for corn, and raising it themselves on their large stock ranches, to finish their cattle. If the English ports are again opened to Argentine live stock, as Argentines hope, it will hasten the development of corn production; for those who are well informed in regard to the cattle trade in England know that the Argentine stockmen can never compete with the corn-fed steers from the United States until they also finish their steers for at least six months on corn. As long as they have only the "frigoríficos" (frozen or chilled meat houses) in Argentina for a market, they will not be in so much haste to begin corn feeding, because for that market, especially for frozen beef, it does not make so much difference. They claim it would not pay to feed corn at present, and it is very seldom done, except for show purposes or some other special reason.

USE OF CORNSTALKS.

Very little use is made of cornstalks in Argentina at present. Usually they are plowed under as soon as possible. Some of the more painstaking farmers gather them into windrows, when dry, and burn them. Scarcely any corn is cut for fodder, nor are cattle turned into the fields after husking to any great extent. Green feed is usually obtained in the pastures all winter. Feeding the stalks, at least in the field, is being looked upon with more favor in the more progressive regions, and in time the corn-harvesting machinery of the United States will be employed in making use of the stalks to the best advantage.

VARIETIES OF CORN GROWN IN ARGENTINA.

Although eight varieties of corn were recognized by the Argentine Rural Society in its catalogue for the agricultural show in May, 1903, only four or perhaps five kinds are recognized commercially. They are here described.

KINDS IMPORTANT IN COMMERCE.

Yellow.—This is the common kind which forms 90 to 95 per cent of the crop and is practically the only kind recognized in European markets. This is a smallkerneled, long and slender eared sort, very much the same as our flint corn. The kernels are very hard and smooth, but it is a very heavy, rich, strong grain and it does not absorb moisture as the softer-grained varieties do; hence it stands a long ocean voyage better. It is highly valued for distilling and for fattening. For the latter purpose it is usually partly crushed, as it is so hard that animals do not masticate it readily. The plant is very sturdy and prolific, usually bearing two or three ears.

Yellow corn goes by various names, the most significant being

“Cuarenton” and “Cincuentino,” from the Spanish words “cuarenta,” meaning forty, and “cincuenta,” meaning fifty. The name is applied signifying the number of days required to begin the formation of ears.

Morocho.—This is a white corn, otherwise somewhat similar to the yellow—small, smooth, and flat. It is preferred for horses, as it is said to be strengthening without being fattening. It is not equal to the yellow corn for distilling.

Polenta.—Polenta is a Piedmontese variety, which originally is small and red, with a smooth, flat grain. It is used to make meal for table use, especially for a sort of mush, of which the Italians are very fond, and from this it gets its name, the Spanish word “polenta,” meaning corn-meal mush. After a few crops this variety degenerates into ordinary yellow corn and fresh seed must be imported. It is seen in all degrees of purity and its cultivation is increasing.

Pisingallo.—This is a small-kerneled, small-eared, white-flint, chiefly from tropical regions. A very good quality, but little grown.

Criolla.—“Maize criolla,” or native corn, is an inferior variety, grown in the northern part of the country, in the provinces of Cordoba, Santa Fe, Corrientes, and Entre Rios. It is yellow, smaller than the other varieties, smooth, and very hard. It is too hard for horses and is of little value for distilling. It yields poorly, has an extraordinary amount of husk and stalk, and ripens slowly. Its chief recommendation is that it is immune from the attacks of locusts, unless they get it in tassel, fresh. It is often sown in case of failure of some other crop, as sometimes happens with corn of other varieties. It is sown as late as the 1st of December and requires sixty days to form ears. The corn brings a poor price in the market and but little of it is offered.

NORTH AMERICAN VARIETIES IN ARGENTINA.

Some of the large North American corn, both white and yellow, commonly called “horse tooth” corn, has been tried in Argentina, but it is not yet popular. They think it is not as strong as the flint varieties they have been raising, and no doubt it will not do as well when crowded as they plant it. It is claimed that our dent corn degenerates in Argentina. But some farmers have a desire to try our varieties and our system, and they will soon get into it. Recent experiments, especially the one by Dr. F. R. Cibils, the well-known Argentine agricultural writer, chief of the Division of Commerce and Industries of the Argentine Department of Agriculture, have shown the adaptability and value of North American varieties in Argentina.

GOVERNMENT EXPERIMENTS ON VARIETIES.

An experiment was made during the season of 1901–2 with twelve varieties of corn, six of them North American, near Pehuajo, 225 miles west of the city of Buenos Aires, on the Western Railway. The results were not as satisfactory as expected, owing, it is said, not so much to

the lack of adaptability of the varieties as to the unfavorable weather of the season. The unusually heavy rains of October and November prevented the plants from getting a good start, and at the end of December they were injured by withering heat. Yet some good results were secured, to be the basis of future experiments. It was demonstrated that the large North American dent corn will give splendid results in Argentina if rightly cultivated in seasons not unfavorable to corn growing.

TABULATED RESULTS.

The seed for this experiment was sent out by the Division of Agronomy of the Argentine Department of Agriculture, after having been carefully tested by that division, which made a report on the seed from which the following information was taken. The country from which the seed was brought, time of planting and of ripening, amount of seed planted and of yield, with other important data, are presented in tabular form for convenience of comparison:

Cultural value, etc., shown by foreign seed corn in Argentina.

YELLOW VARIETIES.

Variety.	Origin of seed.	Purity.	Germinative power.	Cultural value.	Weight of 1,000 kernels.	Weight per hectoliter.	Weight per bushel (Winchester).
		<i>Per ct.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Ounces.</i>	<i>Kilos.</i>	<i>Pounds.</i>
Queen	North America ...	99.38	96.50	95.90	10.09	72.10	56.01
Pedrick's Golden	do	99.10	92	91.17	15.97	69.80	54.23
Golden	Italy	38.40	93	91.51	6.19	81.00	62.93
Precious of Auxonne	France	99.12	71.50	70.87	5.47	75.93	59
Canadian Flint	North America ...	98.10	85.50	83.88	10.31	76.25	59.24
Chester Giant	do	99.20	89.50	88.78	12.67	71.00	55.16
Lombardy	Italy	95.96	60	57.57	16.11	71.47	55.52
King Philip (brown)	France	99	75.50	74.75	10.75	74.87	58.16

WHITE VARIETIES.

Hickory King	North America ...	98.80	97.50	96.33	17.55	69.20	53.76
Neapolitan Grand	Italy	98.25	98	96.29	12.86	72.40	56.25
Horse Tooth	France	96.55	68	65.65	13.11	71.93	55.88
White Head	North America ...	99.40	78	77.53	13.62	69.00	53.60

The following is a summarized statement of the results with the varieties, showing the time of planting and ripening:

Time of ripening, yield, etc., of foreign corn in Argentina.

YELLOW VARIETIES.

Variety.	Time of planting.	Seed planted.	Yield.	Time of ripening.
		<i>Pounds.</i>	<i>Pounds.</i>	
Queen	November 1	4.4	418	May. <i>a</i>
Pedrick's Golden	do	4.4	330	May. <i>a</i>
Golden	End of October	4.4	264	March.
Precious of Auxonne	December 1	4.4	176	April.
Canadian Flint	End of October	2.2	88	March.
Chester Giant	November	2.2	66	May.
Lombardy	End of October	2.2	88	March.
King Philip (brown)	do	4.4	209	May.

a Cultivated twice.

Time of ripening, yield, etc., of foreign corn in Argentina—Continued.

WHITE VARIETIES.

Variety.	Time of planting.	Seed planted.	Yield.	Time of ripening.
		<i>Pounds.</i>	<i>Pounds.</i>	
Hickory King.....	November.....	2.2	165	May.
Horse Tooth.....	End of October.....	6.6	176	May.
Neapolitan Grand.....	November.....	4.4	110	April.
White Head.....	End of October.....	4.4	44	(a)

a Irregular germination.

All except Queen, Pedrick's Golden, and Precious of Auxonne were planted in land that had been used for wheat or linseed, mostly the former. The three exceptions were planted in new land. It is understood the planting was done with a drill, but that the rows were farther apart than is customary in Argentina.

OBSERVATIONS OF FARMER IN CHARGE OF WORK.

The comments of the man in charge of the experiment, who was a practical farmer, are given in substance as follows, touching each variety:

Queen.—Yellow dent. Very productive and suitable to locality. Imperfect grains and incomplete development of ends of ears, but would secure better results by earlier planting, without such heavy rains during first two months of growth. Excellent for distilling, feeding, and meal.

Pedrick's Golden.—Yellow dent. Productive. Grains well developed. Defective ears attributed to unfavorable weather in spring and at time of fertilization. Will do better.

Golden.—Yellow flint. Noted for its resistance to drought. Planted in November and December and matured in three months, with well-developed ears, even at the ends, notwithstanding the weather. Specially good for meal and for porridge.

Precious of Auxonne.—Yellow flint. Quick growing, three months' corn. Ears not so well formed and smaller yield; attacked by fungus. Used mostly for bread and porridge.

Canadian Flint.—Under favorable conditions will mature in less than ninety days, giving long ears of good grains, well formed and even. This variety is said to be well suited to the Argentine market, and to be excellent for bread and "polenta," or corn-meal porridge. In the present experiment the ears were badly formed and were attacked by insects. The variety is well known in the country, and has done well in many localities.

Chester Giant.—Yellow dent. Very luxuriant plants, suitable for green fodder, but badly developed ears, showing degeneration. Will do best in sandy soil. Best for fattening and distilling.

Lombardy.—Yellow flint. Excellent quality, much appreciated for the quality of flour it makes for bread and "polenta." In this case

the ears were few and not well developed, owing to the dry, hot weather at the time of fertilization.

King Philip.—Brown, or wine-colored, flint. Long, slender ears, and under ordinary conditions quite productive. It is well suited to some parts of the country, and has been grown successfully in the Provinces of Entre Rios, Santa Fe, and Cordoba. Its color seems to be against it in the market, though it makes good feed for animals and is valuable for distilling.

Hickory King.—White dent. Best of all white varieties known to experimenter. Well suited to temperate climate, though it has done well in Cordoba and even as far north as Bella Vista, in the Province of Corrientes, nearly 600 miles north of Buenos Aires. The ear is large, but badly formed and undeveloped at the top and bottom. It was not planted early enough to get a good start, and so did not have sufficient rain in its early growth; the heat and drought retarded its development and fructification.

Horse Tooth.—White dent. Good for all purposes for which corn is used, but in this case the result was not good. There was a very small yield of inferior ears, with badly deformed grains. It should have been planted earlier.

Neapolitan Grand.—White flint. Especially desirable for making bread, and hence useful in Argentina. This result was bad; it should have been planted earlier.

White Head.—Seed lacked strength and gave bad results, no grains being fit for seed. The ears were uniform, but the grains were deformed and degenerate. It is not of much importance.

GENERAL RECOMMENDATIONS.

Pedrick's Golden and Golden are recommended as the best of the yellow varieties, and Golden is especially recommended because dent corn is little appreciated in the Argentine markets at the present time. Commenting on this situation, the chief of the Division, Carlos D. Girola, says:

It will be an error to abandon the cultivation of the dent corn, to which the farmers of North America are so devoted and with which they have been so successful. We do not understand why the exporters of corn in this country refuse the dent corn, when such a large proportion of the production and exportation of North America is of these varieties, which have been found so useful for distilling, for feeding cattle, and for making flour. We should now cultivate these varieties for our own consumption, for feeding animals, and for making flour. There is no doubt that this corn will be extensively cultivated in the future when it becomes better known and appreciated, and that it will be more favorably looked upon in the markets. When we have distilleries it will find ample use.

Farmers are urged to improve their methods, to plant the rows farther apart, and to cultivate the corn with more care. They are assured that by doing this they will be getting larger returns for their labor than in almost any other way. "It is a great error," this writer

says, "to suppose that by planting close together a larger crop may be had or the ground kept moist during dry weather."

Speaking of the varieties and quality of corn exported from Argentina, Director Tidblom, of the Division of Agriculture and Animal Industry in Argentina, says:

European buyers of maize have, in ordinary years, a fancy for small-grained maize (corn) and are not sufficiently influenced in favor of really fine quality to pay an extra price to shippers. Therefore the shippers think mostly of the condition and safety for the voyage. If they can get the cargoes home in good order for immediate use, and of average color and plumpness, they are satisfied.

CORN IN THE NATIONAL AGRICULTURAL SHOW.

The agricultural exposition given by the National Rural Society in Buenos Aires in May, 1903, was the first of its kind ever given in Argentina. Live-stock shows on a large scale have been highly successful for the past eight years, but agriculture has received but little attention. This first attempt at a national agricultural exposition was made in connection with the annual fat stock and horse show. It brought together some excellent collections of grains and other agricultural products.

Many samples of various varieties of corn were shown, usually as ear corn. The area from which the corn exhibits came extends north from Tandil, in latitude 37° south, 205 miles by rail south of Buenos Aires—or about the same as Richmond, Va., Wichita, Kans., or San Francisco—to latitude 25° south, including the remote northwestern province of Jujuy and the northeastern territory of Misiones. These latter are nearer the equator than the most southerly point of Florida or Texas.

From Tandil, which is a somewhat higher, cooler locality than the country farther west in the same latitude, came some Morocho corn, a white flint variety, that weighed 63.43 pounds per bushel of shelled corn (81.5 kilos to the hectoliter).^a This was considered very good, as corn from the south had heretofore been light. From the Province of Entre Rios, on the Uruguay River, yellow cuarenton corn was sent that gave 64.49 pounds per bushel on new land. Some yellow flint was brought from Casares, 191 miles southwest of the city of Buenos Aires, that gave 65.2 pounds to the bushel. From Francisco Madero, on the same line 43 miles farther west, some Polenta corn was exhibited that weighed 65.9 pounds to the bushel. Specimens of Morocho were brought from southern Cordoba and from places not far from Buenos

^aThe quality of corn and wheat is judged in Argentine largely by its weight in kilos per hectoliter. The equivalents in weights per bushel are here given for convenience of comparison with American corn, which weighs 56 pounds per bushel of shelled corn.

Aires that gave 64.49 pounds to the bushel. Corn above this weight is considered remarkable. Well-formed ears were shown 11.8 to 12.6 inches long.

CORN FROM TROPICAL REGIONS.

Some corn from the Territory of Misiones, raised in about latitude 26° to 27° south, more than 200 miles nearer the equator than New Orleans and 150 to 200 miles nearer than Galveston, Tex., caused some surprise. It was of a fair quality, not first-class, but good when the methods of cultivation are considered. The soil is a rich red, hardly ever, it is said, less than 3 feet deep, in many places more, and sometimes as much as 30 feet deep. The richness of this soil may be imagined, says the Rural Society's official report of the exposition, when it is known that the method of planting is to throw the seed on the ground without plowing, and then to scratch the soil a little with a pointed stick. This territory, the extreme northeastern part of Argentina, is one of the oldest, richest naturally, and yet least developed and most backward sections of the country. Its only means of transportation to market is the Upper Parana River, so the corn they raise is at present only for local use—to feed a few pigs and chickens. If with these primitive methods, without culture, corn of fair quality can be produced, what might be done on this land if corn was properly planted and cultivated, asks the writer of this report. In some places this land has been giving corn crops continually for eighteen years, and producing ears nearly a foot long. If the manufacture of alcohol is undertaken, utilizing some of the great water power in that part of the country, the growing of corn will, it is said, be greatly stimulated and will be more profitable.

The Province of Jujuy, in the other extreme of the tropical part of the country, sent some of the small Pisingallo corn and also some excellent samples of the larger white-flint corn, Morocho.

A PROSPECTIVE CORN REGION.

It is predicted that the great Territory of the Pampa, southwest of Buenos Aires, which is already giving such good alfalfa, potatoes, and wheat, will soon be yielding good crops of corn in certain sections. Sir Thomas Holdich, the English engineer who settled the boundary dispute between Argentina and Chile, referred to the Pampa as "the granary of the world," he was so impressed by its possibilities.

NORTH AMERICAN KINDS EXHIBITED.

Some samples of North American varieties shown by Dr. F. R. Cibils, chief of the Division of Commerce and Industries of the Argentine Department of Agriculture, prove that the Argentine soil and

climate are well adapted to the production of these varieties. One was a cross of Ohio Flint and Golden corn, producing a perfectly formed, thick, heavy ear, with kernels tightly set, fat, ripe, and hard. This crossed on White Mammoth, "the favorite dent," produced a longer ear, almost white, not quite as well developed at the tip, but still an excellent corn. Chester Mammoth Dent, yellow, gave the largest ears, about 12 inches long, but not so well formed nor as firm, and mixed with white kernels. Yellow Flint of Ohio turned out most satisfactorily, giving long, straight, uniform ears, with thick, heavy kernels closely set and developed to the very tip.

ADVICE TO FARMERS.

The conclusions of the author of the Rural Society's study of this exposition is that to the southwest of Buenos Aires and in the southern part of the Province of Cordoba are now the best corn fields.

Farmers are strongly advised to raise more corn and to raise hogs to eat it, as the most economical production of good pork requires corn feeding. On stock ranches, it is said, every pig that is raised along with corn-fed cattle is as good as each cow giving another calf, and it doubles the value of the corn harvest. The loss of the Brazilian market for Argentine pork products is attributed to feeding pigs on refuse and the consequent low quality of pork sent to market. Even now, the report says, very inferior products are consumed in Buenos Aires when the imported article is not to be had. Argentines are urged to produce more and better pork and to do it with corn. It is even claimed that two crops of corn might be grown in a year, the climate is so favorable.

THE EXPORTATION OF CORN.

SHIPPING FACILITIES AND PROPOSED IMPROVEMENTS.

The facilities for handling grain in Argentina are inadequate, causing delays and losses, and increasing the burden which the producer must bear in getting his crop to market. Shippers must nearly always wait some days to obtain cars, which are distributed by towns, and the railway companies generally require shippers to state what ship the consignments are intended for before cars will be given them in the country stations to load for the seaports, Buenos Aires, Rosario, Bahia Blanca, or La Plata, especially the first named. The docks are so crowded during the busy seasons that the railway companies try to provide cars first for those who have ships ready to load, preventing speculators from cornering the market and filling the yards with grain in order to compel shippers who have ships waiting to pay them an exorbitant price for the grain they must have.

FREIGHT CARS AND CHARGES.

The cars are now being made larger and several of the principal lines have many 35 and some 40 ton cars; but there are still very many 10 and 15 ton English cars in use. Nearly all the railways are owned and, except for minor positions, operated by Englishmen. The railway companies allow three days for unloading cars, for which no extra charge is made; after that, \$1.70 per day. The port of Buenos Aires allows six days free use of its yards for cars unloading; after that there is a yardage charge of 85 cents per axle, the cars having, according to their capacity, from two to four axles. No switching charge is made. Weighing is 12 cents per ton and loading on ship-board costs about 18 cents per ton.

PORTS OF BUENOS AIRES AND BAHIA BLANCA.

The port of Buenos Aires is so crowded that during the busy seasons ships are very often obliged to lie two or three deep alongside and carry loads across each other's decks. This is the more easily done because grain is always in bags, and if shipped in bulk is carried across to the ship in bags and the bags cut open on board. Sailing vessels are not allowed to have berths alongside when any steamer wants a berth. Very extensive improvements are in process of construction by the Great Southern Railway Company in Buenos Aires and Bahia Blanca, which will more than double the capacity of the present docks and moles, the latter being the form of structure at present in use at Bahia Blanca. The latter is a great natural ocean port. Its immense advantage over Buenos Aires, which is only at best a shallow river port, at the mouth of the River Plate, will make Bahia Blanca, with the rich and fast-developing country around it, the future great port of Argentina. The port of Buenos Aires must be constantly protected by dredging and is always liable to have low water, so that ships drawing more than 22 or 23 feet of water are not sure of being able to get out. The river is constantly building new bars and banks and adding to the land with the heavy silt which it carries. In June, 1903, a large European mail steamer was detained four days in the port of Buenos Aires because there was not water enough to get out. The Federal Government has improvements and extensions to the port of Buenos Aires under consideration, planned by Dr. E. L. Corthell, the distinguished American engineer, who was employed by the Government for two years to plan port works and river improvements. These improvements will be commenced in a year or so, when the necessary \$10,000,000 can be secured, and will then afford ample room for all business. The present docks are built of granite, and are first class as far as they go.

RIVER PORTS.

The greatest shipping point, next to Buenos Aires, at present, is Rosario (Pl. V, fig. 2), 188 miles by rail and much farther by water from Buenos Aires. Ships drawing 24 feet of water can load at Rosario by simply lying out in the stream and receiving their cargoes by means of long chutes called "canaletas" (Pl. VI) from warehouses on the high banks. Nothing more is required. The Government, however, has provided for the building of docks there that were planned by Dr. Corthell and will cost about \$10,000,000 gold. The work has been undertaken by a company that is to have the working of the docks and the custom-house there for a long term of years to pay for the docks. The Government does not put a dollar into it, except agreeing to keep the river channel between Rosario and Buenos Aires open for ships drawing 24 feet. At present ships can not safely load more than 18 feet in Rosario, because if they do they are liable to be detained for days on the bar at Martin Garcia, near the mouth of the river, above Buenos Aires. So the larger ships must take part of their loads in Rosario and go to Buenos Aires to complete, and on going in must leave part of their cargoes in Buenos Aires before proceeding to Rosario. The concessionaries have been for some months in possession of the port of Rosario, and are preparing to enforce their monopoly and stop all the cheap loading with chutes. (See Pl. VII.) They are now collecting all port dues, which have been somewhat increased. Many shippers expect to remove their business to other ports because of the increased charges that must necessarily be put on to pay dividends on the costly improvements now in prospect. The Parana River, on which Rosario is located, offers many natural ports for many miles along its high banks, and these are being improved to some extent and made ready to compete with Rosario. Grain men think they can pay freight to any of these small ports and load there cheaper than they can patronize the new port.

LACK OF ELEVATORS AND WAREHOUSES.

No conveniences for loading grain are provided in the country stations. There are no elevators and few warehouses, the latter almost invariably owned by private parties, usually buyers for their own use. There is no public storage for hire, to amount to anything, and if there was the farmers could not be persuaded to pay anything for the use of it. They are very much averse to paying out a single cent that can be avoided; they have not been educated up to the point of spending 10 cents to save \$2, and they follow the practice of losing the \$2 nearly every time. Grain is generally piled up in bags in the station yards, if cars are not ready, and it often suffers damage. Some of the railway companies, especially the Great Southern, have erected sheds for grain. The Argentine Congress has just passed a law requiring all



LOADING GRAIN WITH PORTABLE "CANALETAS" AT ROSARIO.



LOADING GRAIN DOWN A PERMANENT CANALETA, OR CHUTE, AT ROSARIO.

railway companies to provide free shelter for grain offered for shipment. The law went into effect on September 17, 1903, and allows the railway companies eight months in which to build sheds in all stations in the agricultural regions, as directed by the Department of Public Works. At the end of this time the railways will be liable for heavy penalties for failure to provide sheds, and are liable for all damages to grain offered for shipment that is due to lack of sheds. The railways are prohibited from making any charges for storing grain offered for shipment. This law is the outgrowth of the shortage of cars for handling the rapidly increasing grain business, and is intended to force the railway companies to handle the traffic more promptly. Elevators are now being considered and will be built within a few years, as soon as mixed farming becomes more settled and it is possible to say with more certainty what a section of the country will produce to give business for an elevator for any number of years together. Immense elevators are now being built in Buenos Aires and Bahia Blanca. There are several in Rosario, but they have not been in general use for several years. It is claimed the charges were prohibitive. One of them has been used by a corn-shipping firm for cleaning and drying corn, and with excellent results.

METHODS OF LOADING AND SHIPPING.

HANDLING AT PORT OF SHIPMENT.

Corn is usually exported from Argentina in bags of about 155 pounds weight. A year ago it was estimated that 90 per cent of the exportation was in bags and only 10 per cent in bulk. The proportion of bulk shipment is now somewhat greater. Sometimes cargoes contain both bagged and loose corn. In case of separate parcels in a ship belonging to different shippers, the bags are marked and piled separately.

In Buenos Aires and La Plata bags are either carried on board by men or swung on from cars alongside the docks by hydraulic cranes or steam winches. Corn to be shipped in bulk is always carried on board in bags and the bags cut open and emptied into the hold.

In Rosario several means are employed, chiefly the "canaletas," which are long, wooden chutes made in sections and swung on cables from the elevator or warehouse on the high bank to the ship lying in the stream below, as shown in the illustration (Pl. VI). In some cases grain has been loaded in bulk by the same system, with spouts. In another part of the port, where there are no high banks, the hydraulic crane and steam winches are used (Pl. V, fig. 2). In the smaller ports on the Parana and Uruguay rivers the "canaletas" are used.

At Bahia Blanca grain is loaded by steam winches from the cars, by men carrying the bags on board, and by a system of endless chains, carrying the bags a distance of about 100 feet from the cars to the ship's side, where they are slid into the hold. For handling in the dock

the charge is 35 cents gold, per metric ton of 2,204.6 pounds. For handling from the deck, either putting bags in the hold or cutting bags open and allowing the contents to fall into the hold, the charge is 16 cents gold, per ton. The commercial seaport of Bahia Blanca is 4.35 miles from the city. The railway company charges 65 cents gold, per ton for switching cars from the city yards to the shipping port. Another railway company has a mole also, and the switching charge between this mole and the city, 9.31 miles, over two railways, is \$1.36 gold, per ton. The endless chains, working on two ships at a time, loading into all hatches, expect to load 1,500 tons of grain per day into a ship. It is a very dusty place, full of fine sand, which is very damaging to exposed machinery like this. The facilities are greatly inadequate, but extensive improvements now under way include huge elevators, large docks in addition to the present steel mole, and modern equipment for loading in bulk. The whole system is owned by the Great Southern Railway Company, the principal railway of South America, which controls transportation in the best part of Argentina, and is giving serious consideration to the construction of grain elevators and warehouses. Some lightering is done at Bahia Blanca when the mole is crowded and ships are waiting. The lighters are of 350 tons burden and the charge is 30 cents per ton. The bags are lifted from the lighters by steam winches on board the ships. Portable elevators are never used.

OCEAN TRANSPORTATION AND CHARGES.

Corn exported from Argentina to Europe and England is generally carried in tramp steamers of from 2,500 to 6,000 tons burden, that require about thirty-five days for the voyage. Some shipments are made in liners or mail steamers, requiring only twenty-one to twenty-four days for the voyage. A very small amount goes in sailers, which require seventy to one hundred days to go to Europe, quite too long for grain shipments. Liners are preferred on account of their quick service, and they often take corn at low rates for ballast when the freight market is dull. Sailing vessels take corn to South Africa because, owing to favorable winds, they are able to make the voyage from the River Plate in twenty-five to twenty-eight days. Steamers do it in fifteen to eighteen days—usually fifteen.

The condition of the freight market constantly varies. Crop conditions, the wool market, favorable weather for handling corn, the demand for tonnage to Brazil and South Africa, as well as to the River Plate countries—all these things and other influences affect the supply, character, and price of tonnage from Argentine ports to Europe.

Liners bring general cargoes from Europe and carry back grain, hay, frozen or chilled meat, and other produce. They can not wait for cargoes, hence sometimes make liberal offers for business. Tramp steamers do a great variety of things, as the season and conditions

suit them. If they are assured in advance of a profitable return cargo they will come out from Europe in ballast, when the demand for tonnage for other parts of the world permits them to do so. Frequently they bring coal, and sometimes general or special cargoes. Often they bring cargoes to Brazil and go to the River Plate, 1,100 miles, or five days' voyage, in ballast. Recently quite a number have been going to South Africa loaded and crossing to Argentina in ballast. Sailors go in ballast to some United States or Canadian port and load lumber for Argentina.

CARE IN TRANSIT.

Sometimes temporary wooden bulkheads are put in front of the engine room, leaving an air chamber a foot wide, which is kept full of fresh air to prevent heating the corn. But this is an unusual precaution, not the rule. Indeed, it is claimed that the corn next to the bulkheads, where there is most heat, often comes out the best. Occasionally a ship will be lined with straw matting or matting made of the tall rushes that grow in the Parana River, but this also is the exception, especially as most of the corn is bagged.

RAILWAY FREIGHTS.

Freight rates in Argentina are high, compared with the United States. The railways, being nearly all English and owned by the same group of capitalists, have long and very favorable concessions from the Federal Government, under the supervision of which they all are.

The rates on corn on one of the principal lines were as follows in 1902:

Freight rates by rail in Argentina.

Number of miles.	Rate per bushel in United States cents.	Number of bushels carried for 41 cents, at bushel rate.
25	2.74	14.96
50	3.92	10.45
100	6.10	6.72
200	8.92	4.59
300	11.03	3.71
400	12.99	3.15
500	14.38	2.85
600	15.76	2.60
700	17.13	2.39
800	18.50	2.21
900	19.87	2.06

These rates are a trifle higher than those in force on some other lines traversing corn regions. Rates on Argentine railways are quoted in Argentine gold per 1,000 kilos (2,204 pounds), and are divisible in fractions of 10 kilos. Very little corn in Argentina is shipped more than 200 miles by railway, and most of it less than 100 miles.

Freight rates on corn in the United States in 1900, according to statistics published by this Department, were as follows, in cents per bushel:

Chicago to Buffalo by lakes, 1.71.

Buffalo to New York by canal and river, 2.31.

Chicago to New York by lakes, canal, and river, 4.02.

Chicago to New York by lake and rail, 6.44.

Chicago to New York, all rail, 9.19.

Atchison, St. Joseph, Kansas City, or Leavenworth to Chicago, 16 cents per 100 pounds, or 8.96 cents per bushel.

Atchison, St. Joseph, Kansas City, or Leavenworth to St. Louis, 11 cents per 100 pounds, or 6.16 cents per bushel.

St. Louis to New Orleans by river (in sacks), 10 cents per 100 pounds, or 5.6 cents per bushel.

Rates at present in force from Iowa points to Chicago are 17 cents per 100 pounds, or 9.52 cents per bushel, in carload lots.

OCEAN FREIGHT RATES.

Ocean freight rates on corn from River Plate ports vary considerably according to the condition of the freight market. Now the range is from 8 to 20 shillings per shipping ton of 2,200 pounds. The charter rate from Buenos Aires, in good tramp steamers, is at present about 13 to 17 shillings per ton. From upriver points, such as Rosario or San Lorenzo, the rate is usually one shilling sixpence to three shillings higher because steamers may not always load to their limit there, but must stop at Buenos Aires to finish. They can not get across the bars on the way down with a full load drawing more than 18 feet, except at unusual stages of the river.

Rates in shillings per shipping ton of 2,200 pounds converted into cents per bushel, United States money, are as follows:

8s. per ton equals	4.95c. per bu.	16s. per ton equals	9.91c. per bu.
10s. per ton equals	6.19c. per bu.	17s. per ton equals	10.53c. per bu.
12s. per ton equals	7.43c. per bu.	18s. per ton equals	11.15c. per bu.
14s. per ton equals	8.67c. per bu.	20s. per ton equals	12.38c. per bu.
15s. per ton equals	9.29c. per bu.		

The range of ocean freight rates on corn from New York and Boston to European ports during May, 1903, was as follows, in cents per bushel:

Ocean freights on corn from United States to Europe.

To—	From New York.	From Boston.
Liverpool	3.04	3.04
London	2.02 to 3.54	4.05
Glasgow	3.04	3.04 to 4.05
Hull	5.57	6.08
Hamburg	4.76 to 5.23	5.06 to 6.08
Rotterdam	3.00	5.06
Marseille	6.08
Copenhagen	8.11 to 9.12	8.11
Havre	9.12
Genoa	4.56 to 5.06

EXTENT OF EXPORTS OF CORN FROM ARGENTINA.

Argentine exportation of corn from 1886 to 1902, inclusive, has been as follows, in bushels, with the valuation in United States money:

Total exports of corn from Argentina, 1886 to 1902.

Calendar years.	Quantity.	Value.	Calendar years.	Quantity.	Value.
	<i>Bushels.</i>			<i>Bushels.</i>	
1886.....	9, 119, 970	\$4, 490, 551	1895.....	30, 404, 504	\$9, 836, 571
1887.....	14, 245, 035	6, 983, 595	1896.....	61, 827, 888	15, 434, 756
1888.....	6, 389, 699	5, 253, 908	1897.....	14, 760, 664	5, 286, 963
1889.....	17, 030, 168	12, 523, 501	1898.....	28, 230, 887	8, 949, 600
1890.....	27, 844, 175	13, 650, 542	1899.....	43, 945, 394	12, 586, 479
1891.....	2, 594, 692	1, 335, 645	1900.....	28, 079, 045	11, 516, 066
1892.....	17, 555, 505	8, 261, 588	1901.....	43, 788, 911	18, 226, 338
1893.....	3, 327, 135	1, 523, 296	1902.....	46, 959, 122	22, 189, 268
1894.....	2, 160, 370	1, 009, 397	1903 (estimated Nov. 5)	78, 750, 000	31, 500, 000

The distribution of Argentine corn exports for 1902 to the several countries of destination is shown in the following table:

Countries importing Argentine corn in 1902.

Destination.	Bushels.	Destination.	Bushels.
United Kingdom.....	11, 658, 515	Spain.....	305, 731
Germany.....	4, 738, 985	Brazil.....	74, 445
Belgium.....	4, 252, 870	Other destinations <i>a</i>	4, 166, 497
France.....	2, 046, 066	For orders <i>b</i>	18, 759, 099
Italy.....	956, 914		

a Including all other European countries and South Africa.

b Cargoes going to St. Vincent to receive orders to proceed to some European or English port, where the cargo has been placed during the voyage from the River Plate to St. Vincent.

INSPECTION.

LACK OF GOVERNMENT INSPECTION.

There is no Government inspection of corn in Argentina, for export or for any other purpose. The Argentine Department of Agriculture has studied the subject, and shippers, shipowners, and grain associations have been consulted, but nothing has come of it beyond the resolve to create a commission to look into the matter when the funds for such purpose can be spared. Grain exporters have not taken kindly to the idea. They do not want any Government interference with their business. Those who are taking the necessary precautions and shipping nothing but grain they know will go through without loss do not require any inspection. Those who are in a speculative trade, taking chances on buying poor grain at a low price, hoping to make a large profit if it arrives in fair condition, do not want the Government to injure their business by inspecting and grading this corn for what it appears to be before exportation. Often they lose heavily on these speculative cargoes, but the profit is so great if they succeed in getting them across without further damage that they will take long

risks. Cargoes arriving in bad condition often recover and are sold at better prices than the arbitration allowances. It is quite difficult, as the Argentine Government officials have found, to get the results of experience that has cost shippers thousands of dollars to acquire. They prefer to go on quietly making use of it themselves, leaving others to learn in the same way they did. But during a year's time the writer found many opportunities to learn and observe the methods employed by the most successful and conservative shippers of corn from Argentine ports to England and the Continent. They were quite willing to answer questions, and were kind enough to afford means for personal inspection of the details of their shipping arrangements.

PRIVATE INSPECTION.

The only grain-inspection system in Argentina that is accepted in Europe and England is that established and conducted by an Englishman who served formerly as the English Government inspector of hay, bran, etc., bought in Argentina for the army in South Africa. This gentleman inspects all kinds of grain and hay for foreign buyers, and owing to his long experience in Europe, the United States, Australia, and Argentina, and to his conservative and thorough policy, his certificates are accepted, and cargoes passed by him have so far arrived in good condition. Offices are maintained in the principal ports of export, and inspectors are sent to other ports and to inland stations to receive grain and hay. Another inspection is made of grain and hay received in country stations before it is loaded on ship-board, because of the danger of damage, especially to hay, en route from the country stations to the seaboard. The prices charged for corn inspection range from 1 to 3 cents per bushel, according to the port or place of inspection and the amount of work required. When this system is not employed grain is sold from Argentina to Europe on "rye" or "tale quale" terms.

GRADING CORN FOR EXPORT.

There is little grading of corn in Argentina for export, except such as is done by individuals. Corn that is suitable for export is known as "export type," being generally the small-grained, hard yellow or white, and dry and sound. Beyond these general requirements there is no common standard in the Argentine markets. Every buyer fixes his own standard according to his own ideas to fit the market in which he expects to sell. Corn is usually shipped under the denomination, "fair average quality at time and place of shipment, shipped in good order and condition." If the grain is exceptionally good, it is designated as "prime quality." In all cases it must be sound, clean, and dry enough, in the opinion of the inspector, to stand the voyage and arrive at destination in good order.

In the local markets there are three regular grades of the two principal kinds of corn known to commerce. Both "Maize Morocho," or white corn, and "Maize Amarillo," or yellow corn, are graded as follows: (1) Good to superior; (2) inferior to ordinary; (3) exportation type.

PRICES.

The white corn has usually brought a trifle better price than the yellow, but more of it is now being produced than formerly and the price is about the same. The range of prices is not very wide. Corn is always sold by the 100 kilos, equal to 220 pounds avoirdupois. A sample quotation will show how the prices ranged, though at present there is not the difference in the prices of yellow and white corn. The quotations given here were in force in May, 1902.

Prices of corn in Argentina in 1902.

Kind of corn.	Price per 100 kilos in Argentine paper money.			Price per bushel in United States money.		
	Lowest.	Highest.	Average.	Lowest.	Highest.	Average.
White:						
Good to superior.....	\$5.80	\$6.30	\$6.00	\$0.64	\$0.70	\$0.67
Inferior to ordinary.....	5.00	5.80	5.50	.55	.64	.61
Exportation type.....	5.35	5.70	5.50	.59	.63	.61
Yellow:						
Good to superior.....	5.20	6.00	5.50	.58	.67	.61
Inferior to ordinary.....	4.40	5.50	5.00	.49	.61	.55
Exportation type.....	5.35	5.40	5.35	.59	.60	.59

These quotations range from 49 to 70 cents per bushel in United States money, the export yellow selling for about 59 cents per bushel. At this time corn was selling in Chicago for 57.3 cents per bushel and in New York for 63.3 cents per bushel.

In July, 1903, the prices in Argentina for the best export corn were around \$4 Argentine paper per 100 kilos, or equal to about 44 cents per bushel in United States money. This is about 10 per cent lower than the prices at the same time in 1902. The prices in Buenos Aires November 7, 1903, were from 31 to 40 cents per bushel, or 40 to 41 cents for the best export type, about 20 per cent lower than on the same date in 1900.

The average prices for corn in the Buenos Aires market for six years ending with 1901 is given officially by the Argentine Department of Agriculture as follows, in cents per bushel, United States money:

	Cents.		Cents.		Cents.
1896	24.55	1898.....	34.31	1900	37.23
1897	44.44	1899.....	30.42	1901	48.62

The prices for 1902 were not available, but the average was not far from that of 1901.

IMPORTANCE OF DRYNESS IN CORN FOR EXPORT.

The chief care of the shipper of corn from Argentina is to secure dryness, and that vital quality is harder to obtain than any other. It is not too much to say that three-fourths of the losses on Argentine corn going to Europe have been due to the dampness of the grain before it left the River Plate. The shipper has a constant fight to avoid receiving corn that is full of moisture; to keep it dry after he has received it; to get it on board ship in the same condition; and then to get the ship out of the River Plate before the cargo has absorbed much of the humidity that prevails there during the greater part of the shipping season. If the ship in which corn is loaded gets away within fifteen or twenty days after she begins to load, and the loading has been done with dry grain in dry weather, and the hatches of the ship are securely battened down and, as nearly as possible, hermetically sealed during the entire voyage, the general opinion among the most successful shippers now is that there is practically no danger of damage to the cargo during the voyage. They have largely abandoned the ventilation theory.

CONDITIONS UNFAVORABLE TO DRYNESS AND CLEANNESS.

But many difficulties arise to prevent sending away corn under these favorable conditions. First, there is the faulty cultivation and harvesting, already referred to. Owing to these causes corn is slower to ripen and dry in the field than it should be and the inability of the farmers to get help for the gathering prevents them from husking their corn before the rains of June, July, and August have soaked it. The exception to this is the early corn that is gathered and marketed too soon. A comparatively dry winter is of great advantage to all who are interested in corn, but it is the exception. Of course there is no snow.

Shippers of corn usually send inspectors to the country stations to examine the quality of grain offered. This is done with a long tube, or spear, the same kind that is used for testing wheat. It is thrust into the bag, bringing out a section of the contents and showing its quality all the way through. This testing is done as the bags are being carried from the pile to the railway car, and it may be done again in the port. It requires considerable exertion and the sense of touch of the inspector is likely to become dulled after a time, especially if the condition of the corn varies much and a large proportion has to be rejected for dampness. Inspection is also often made in the "troja," or crib, before the corn is shelled, as the dryness of the cobs plays a very important factor in the dryness of the grain after shelling and it is easier to make sure about it in advance. The cobs being dry and shelling being done in dry weather, the maximum of security is obtained; but dry weather is not always to be had when machines are available.

Every effort is made to get the corn on board ship as soon as possible after it is shelled, but the country roads are generally bad at this season of the year, there is difficulty in getting cars, and often delay occurs in the port while the ship waits for her berth to load. All this time the corn is absorbing moisture more or less. A few shippers have tried to minimize the bad effects of this system by cleaning and drying the corn to some extent before shipping. The shelling machines in use remove the dirt very well, unless the corn is wet when shelled; but a great amount of "fluff," or chaff, is left with it, and this helps to create heat on board ship. Aside from this, Argentine corn comes to market fairly clean and not many complaints are heard on this score. Still, it is generally agreed among those who are well informed that it would be very much better if corn could be put through a cleaner or elevator for the removal of dirt, dust, and chaff that comes out easily within a few days after shelling.

CLEANING CORN BEFORE SHIPMENT.

In Rosario two leading grain houses clean corn before shipping, chiefly to take out the "fluff," which they say contributes very much to the chance of heating on the voyage. One firm has leased an elevator at a low rental and uses no heat. They get an astonishing amount of chaff and small pieces of cob out of the corn—almost enough to furnish fuel for the engine that runs the elevator. This is one of the most conservative English firms, and is very careful not to buy corn on which there is a risk. They shipped many thousands of tons last year and not a single cargo went wrong.

Another house that does a very large business has put in an apparatus to dry as well as clean the corn. It is heated by hot air, and then passed through dry, cool air to take out the heat. But this is not altogether a success, because a certain amount of heat remains in the grain as it goes on board. It would not pay either of these firms to put corn through elevators at the current charges, they say, and no others do it. There is no kiln-drying. The cost of fuel would prevent it, if nothing else did.

UNCERTAINTIES IN THE TRADE.

The most perplexing uncertainty exists in regard to the shipment of corn. It may appear to be dry, and yet not be. Sometimes when it is not it stands the voyage with but little harm. Heating and fermentation are produced by different causes and may be chargeable to qualities of the grain or to surrounding conditions. The line is not always honestly or intelligently drawn between harmless sweating and injurious fermentation. Complaints are made of the decisions of the arbitrators in Europe and England, that they have not so distinguished, and that cargoes have been sacrificed at much greater loss

than the true conditions warranted. It has been suggested that arbitrators should be supplied with samples, and should establish a standard distinguishing between corn that is really damaged and that which has only been discolored by the heating of the oil in the grain without damage to the starch therein. Isolated bags of bad corn may get in among many which are in good condition and cause great damage in spots. The imperfect formation of starch in corn in backward seasons, which can only be determined by chemical analysis, is another cause contributing to fermentation on the voyage. All these conditions have increased the reluctance of the Argentine Department of Agriculture to undertake to inspect and certify to the character of corn or other grain without having a thorough scientific study of the conditions made, with sufficient careful experimentation to remove all doubts.

VENTILATION DURING THE VOYAGE.

Of one thing, however, the officials of the Department who have studied the problem are quite certain—that ventilation of a cargo of corn during the voyage is a very great error. This is the chief point of discussion among those interested in the grain trade, but the great majority of evidence, opinion, and practice is now against ventilation, as far as shipments from Argentina are concerned. Concerning the risks of the voyage, Señor Don Ronaldo Tidblom, chief of the Division of Agriculture and Animal Industry in the Argentine Department of Agriculture, has given me the following statement:

For what is called “ventilation” during the sea voyage it is customary to introduce damp sea air into the ship’s hold: and, indeed, if such “reasonable precautions” are omitted, the shipowner is liable to damages for the heating of a cargo; although it is really absurd to think that there is any really effectual ventilation of a mass of grain, unless an elaborate system of pipes be provided for forcing air into every part of the holds: and practically this is impossible with bagged cereals when the spaces between the bags are filled with loose grain for better storage.

The state of the weather during the time of shipment is of great importance; because grain coming from the interior may absorb considerable moisture while waiting in railway cars or lying in the open holds of a steamer for some weeks at various river ports during a spell of damp weather. It is difficult to see how this can be avoided when steamers collect cargo at up-river ports, or wait for cars, because of the intense dampness of many days and of nearly all early mornings during the winter.

The absorption of moisture could be greatly avoided if all cars, on arrival, were discharged into closed warehouses, from which grain could be loaded with great dispatch by means of covered chutes, and the injurious effects of moisture would not have to be feared if the grain were kiln-dried before loading. Unfortunately, these closed warehouses and kilns have yet to be built.

Under the present conditions, after maize has collected moisture, perhaps for weeks, at the seaboard the steamer proceeds to tropical seas, where not only is the action of the sun upon the iron decks very severe, but also the water is hot and the air exceedingly damp. The hatches are removed occasionally and the ventilators are at work day and night pouring in fresh damp air. The idea is that “heated air will escape in the form of injurious gases,” but what really happens is that it is

replaced by air containing oxygen, which assists in fermentation, just as fresh air assists in combustion in a furnace. If the holds were closed the air would soon be exhausted of oxygen and the process of fermentation would be correspondingly reduced.

It must also be borne in mind that heat alone will not injure maize and that a moderate amount of heat will evaporate a sufficient amount of moisture from a cargo during the voyage to improve it considerably if there has not been active fermentation. It is remarkable that Argentine maize carried in bunker holds, where it is subjected to moderate heat during the voyage, usually arrives in better order than the rest of the cargo. On the other hand, that part of a cargo which is under the direct action of the ventilating shafts is always in the worst condition. It is, therefore, not surprising that even good maize often fails to stand the ordeal of an extended ocean voyage, more particularly as it is shipped in cold weather and discharged in hot, or vice versa.

A great majority of shippers whose views were obtained and whose practices were observed were opposed to ventilation. There appears to be a modification of the ironclad rule of shipowners requiring ventilation, as stated by Señor Tidblom; since much corn is shipped with strict orders not to open the hatches, which are sealed as tightly as possible. The English firm in Rosario, referred to previously, sends all its cargoes that way.

OPINIONS OF AN EXPERT.

The most thorough study of the question of handling corn that has been made in Argentina was that of Mr. William Goodwin, F. R. G. S., now retired and living in England. He was a little more than two years ago one of the leading grain exporters, and at the same time inspected grain and hay for shipment by others to Europe. He had a very large clientage in Europe and England and his certificates and opinions were received as authority. Having lived for many years in Argentina he had excellent opportunities for observation and study, which he used with good results. Mr. Goodwin has written numerous letters and circulars to the grain trade giving his experience and opinions about the best means of shipping corn to avoid loss by heating on the voyage. He has gone to the root of the trouble—the bad system of cultivation—and in a formal article in the official bulletin of the Argentine Department of Agriculture he gives much good advice to corn raisers in Argentina. One of their worst mistakes, he says, is in planting more than they can properly care for or harvest. They begin gathering too early, before there is any frost to perfect ripening, and later are unable to get help to gather in the best months. The husking is carelessly done, often on rainy days and early in the morning when it is wet, and wet husks and dirt are taken with it. Farmers are advised to undertake no more than 110 to 130 acres to a family and work it better.

Often it is impossible to fill a ship with a good quality of corn, and at last the cargo is completed with grain that should never have gone

in. Probably the ship has been waiting for many days, badly and slowly loaded, with open hatches in wet weather. She may be overloaded at Rosario and have to wait a week or more for high water to cross the bar at Martin Garcia, just above Buenos Aires. In this way the cargo is given every opportunity to absorb moisture before sailing. This generally results in heavy losses at the point of destination.

Mr. Goodwin is quite sure that if ripe Argentine corn is shelled in dry weather and loaded promptly on a ship sailing at once, with the hatches tightly closed during the entire voyage, there will be no trouble at destination. He says it is "not only richer in food constituents, but of much better carrying nature than either North American or Danubian maize." Shipments must be made from Argentina before summer, because in the intense heat the "maize fly," or "palomita," and various micro-organisms develop. Besides, the wheat crop is then demanding the attention of the farmers, and wool shipments are at their height.

Under date of March 10, 1901, Mr. Goodwin, in a circular to the grain trade, expressed the following opinions concerning the shipment of corn and ventilation on board:

A seed grain must be considered as a living entity, composed of minute cells, although its activity of life can be suspended for a long time under certain conditions; and we must study the most practical and economical method of providing those conditions.

It may be roughly said that moisture, air (oxygen), and sufficient heat are necessary for animal or vegetable life, including micro-organisms, and that the active life of a seed can be suspended for a time if any one of the three be withheld.

Of course the best thing to do with grain is to make it really dry and keep it so; but apart from the difficulty of this work in damp weather, on farms or in ordinary warehouses, it must be remembered that grain, especially maize, absorbs moisture from the atmosphere, and also that somebody loses money when grain loses weight. Furthermore, there is a point beyond which drying is unnecessary for the after processes of milling, etc.; and it may be more economical to exclude the second factor, air.

At this point we come to consider the reasons for what is called ventilation on board ship and to note that when grain is thoroughly exposed to air it does not suffer from an excess of heat, as for instance, when in thin layers on a warehouse floor, or when bags are stowed in open order, and in that way it is protected from fermentation, but not from moldiness.

The ventilation in a steamer's hold has a very local and partial effect on the entire mass of grain, and was designed for letting out gases, being advisable for coal cargoes, but without any scientific reason for grain cargoes; and cargo surveyors say that the greatest amount of damage is to be found within range of the ventilators, the least being at the bottom of the hold where there is least access of air, of course always supposing the grain to be of similar quality and condition. In fact, it may be said that ventilation, if thorough, is effective, but if partial is very dangerous.^a

^a In another and subsequent article, of an official character, Mr. Goodwin said: "It is dangerous to trust ventilation to any one but an expert. It is easy to let out heated, expanded air, but if cold, damp air is admitted it will increase the fermentation. If a competent person was in charge, possibly a little ventilation during hot and dry weather might be good, but as a rule it is to be guarded against."

Heat, the third factor, may come from the sun, but on board ship may be the result of some grains germinating, or else it comes from direct fermentation. The heat generated in brewers' vats is well known, and Pasteur demonstrated that it is microbic action, but we do not always consider that the mechanical action of a growing seed develops a considerable amount of heat, and this heat may, in a grain cargo, cause fermentation.

The investigation of what is called heating of grain is complicated early in the season by what is called "sweating," a natural process happening at uncertain periods, which has so far not been scientifically explained. We know from experience that grain is improved by sweating and loses moisture, so that fresh grain may sweat on board ship and yet arrive in good order; also, that it should not be disturbed during the process, but it is sometimes difficult in practice to distinguish from fermentation, and further information is badly wanted.

In another circular Mr. Goodwin said:

Ventilation (before shipping) is especially necessary for the removal of the fluff and the mealy dust which comes from the point of the maize grains, which can not be properly removed at the time of shelling and causes much of the heating afterwards. A few frosts are always to be counted on to kill the plants: but there is nothing answering to the winters of the United States; although during October and November the weather is almost always suitable for shipments, and by that time the grain has become dry. With December, however, comes wheat harvest and also considerable heat, which develops weevils and maize fly, and prevents the carrying over of grain to another year; so that under the present conditions of the trade there are only some three months of entirely good weather for shipping an export surplus that may any year amount to 2,000,000 tons.^a

ANTISEPTIC GRAIN STORAGE.

In September, 1900, Mr. Goodwin published the following letter in London advocating the shipment of corn in chambers sterilized with carbonic acid gas:

Business men are sometimes slow in making practical use of scientific discoveries: and although a large quantity of grain, and especially Argentine maize, that is shipped in apparently good condition, arrives in Europe heated and decayed, the real cause of this trouble does not seem to be studied according to the lights of modern science; nor is the fact that Indian peasants can keep their grain for many years in underground pits appreciated properly.

Some twenty-five years ago Pasteur demonstrated that fermentation does not result from the generation of gases, but from the action of living microbic organisms; and it is now known to bacteriologists that some 95 per cent of the germs which cause fermentation in grain require oxygen as well as a certain amount of heat and moisture for their development. It is also known that under favorable conditions their rate of increase is prodigious.

The vitality of these germs can be suspended by a sufficiently low temperature, as is done in refrigerator chambers for fresh meat; and although it is impracticable to apply cold storage to cargoes of grain it should be easy to sterilize the air in the holds of a steamer sufficiently to retard fermentation without causing any injury to the grain or to the crew, if suitable precautions are taken. On the other hand, what is called "ventilation" of the holds is surely a grave error if Pasteur is right, and must assist fermentation just as the admission of fresh air assists combustion in a furnace.

^aThe exportation of the present year will, it is estimated, equal that amount.

It is interesting to note the arrival last week in London, free from weevils and in perfect condition, of a cargo of Argentine maize which appears to have been treated antiseptically; and this has occurred at a time when all other Argentine maize cargoes are arriving in bad order and when claims for damage during the voyage have been settled for some £12,000 in one week.

Attention has been called to this cargo because a grain sampler, who, without permission, removed the hatches of one of the holds and went down, became insensible and died forty-eight hours afterwards from the effects of inhaling carbonic acid gas. Evidence was given at the inquest to the effect that the maize had been sprinkled during shipment with some chemical preparation and that the holds had been kept closed during the voyage. A verdict of accidental death was given, but the jury censured the shippers for using chemicals and the captain of the steamer for having allowed them to do so, and also for having neglected to ventilate the cargo; a verdict that may have unpleasant after consequences, because of precedents established by the rulings of judges.

About three years ago the owners of the steamship *Belasco* were condemned to heavy damages because some of the hatches and ventilators were closed during the voyage; and many steamship owners immediately gave their captains notice that they must be able to prove that ventilation had been provided and used, notwithstanding any instructions to the contrary on the part of shippers of the cargo.

Chemists say that inexpensive compositions of a perfectly harmless nature in their after effects on human food can be used to sterilize an air chamber—that is, either to consume or drive out the oxygen contained in atmospheric air—and that their application to the holds of a steamer or to suitable warehouse silos would only need reasonable precautions: but it is very desirable that some joint action be taken by grain trade and steamship associations, not only to arrange for a careful study of the entire subject in order to ascertain what methods are safe and efficacious, but also to protect, as far as possible, from unfair legal penalties shippers and others who make the necessary experiments; because when juries or arbitrators have to decide on cases of death by misadventure or damage to produce there is always a tendency to deal harshly with any departure from old methods.

The logical sequence of Pasteur's discovery should be a radical change in the method of storing grain, and indeed nearly all other food products; and it would appear that the air in storage chambers, at sea or on land, can be more economically sterilized with carbonic acid gas than by any refrigerating process. The subject being of national importance calls for proper investigation.